UNIVERSITY OF PENNSYLVANIA

EFFICIENCY IN RAILROAD MANAGEMENT
A STUDY OF THE REQUIREMENTS OF SECTION 15a OF THE TRANSPORTATION ACT
1920

VEN WAY WOO

A
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To
The Loving Memory
of
My Father and Mother

R. UNIV.
BIBLIOTHEEK
LEIDEN

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SUMMARY

1. The efficiency clause is the keystone of the rule of ratemaking provided in section 15a.

2. Efficiency in railroad management is the efficiency with which railroad facilities and railroad labor are being utilized.

The utilization of railroad facilities, up to 1918, has been great, as indicated by the greater volume of traffic handled and the little increase made in railroad facilities both fixed and movable, resulting in greater density of traffic and heavier loading of trains and cars. Since 1918, the increase in railroad facilities has been more than the normal increase in traffic, resulting in the reduced utilization of railroad facilities. Better operating results were, however, made in 1923 and 1924.

Railroad labor, since 1915, has been less utilized, chiefly due to the establishment of the eight-hour basic day in 1916 and the payment of overtime at punitive rates and of unproductive service hours. Since 1920, however, improvements have been made in the better utilization of railroad lobor.

Both the utilization of railroad facilities and that of railroad labor are effected by the influence of business cycles, the extent of which is difficult to be determined.

3. Since the enactment of the act, the Commission has accomplished something along the line of enforcing efficiency in railroad management, but has followed no definite program nor policy in administering the law, chiefly due to the dubious misunderstanding on the part of the Commission of its duties required by the act. In view of the inadequacy and limitation of statistical information, organized investigation and field study by the Commission is absolutely necessary. This could be done only by a separate organization specially devoted to the work.

4. The failure of Congress in appropriating necessary funds for the Commission to set up an organization was in some measure responsible for the Commission's misunderstanding of its duties. The present "Section of Efficiency and Economy" with four persons in charge is necessarily insufficient to carry out the requirements provided in the law and therefore should be fundamentally reorganized and considerably expanded. This could be satisfactorily realized with a reasonable appropriation of, according to expert estimates, about $150,000 or $200,000. In view of the great savings that might be made, we believe that Congress could do nothing more worthwhile than appropriate the necessary money for the Commission to perform its duty as required of it by the law.

EFFICIENCY IN RAILROAD MANAGEMENT A STUDY OF THE REQUIREMENTS OF SECTION 15a OF THE TRANSPORTATION ACT 1920

I

INTRODUCTION

Paragraph 2 of Section 15a of the Transportation Act, 1920 provides that "In the exercise of its power to prescribe just and reasonable rates the Commission shall initiate, modify, establish or adjust such rates so that carriers as a whole (or as a whole in each of such rate groups or territories as the Commission may from time to time designate) will, under honest, efficient and economical management and reasonable expenditures for maintenance of way, structures and equipment, earn an aggregate annual net railway operating income equal, as nearly as may be, to a fair return upon the aggregate value of the railway property of such carriers held for and used in the service of transportation..." It is further provided in paragraph 3 that "The Commission shall from time to time determine and make public what percentage of such aggregate property value constitutes a fair return thereon... In making such determination it shall give due consideration, among other things, to the transportation needs of the country and the necessity (under honest, efficient and economical management of existing transportation facilities) of enlarging such facilities in order to provide the people of the United States with adequate transportation..."

Under this system of governmental regulation of railroads, rates are to be made "just and reasonable" and to be established by the Commission at a level in such a way as to yield a "fair return", the percentage of which is to be determined by the same body, upon the carriers' aggregate value of property which

is to be ascertained also by the Commission *with the condition* that the managements are "honest, efficient and economical" and expenditures for maintenance of way, structures and equipment are "reasonable". It is clear that a failure in meeting these conditions would immediately render the return excessive and the rates unjust and unreasonable. As a matter of fact, the efficiency requirement is the keystone of the whole structure of the so-called rule of rate-making which makes up the new Section 15a of the Transportation Act. A discussion of all the phases of this rule of rate-making is beyond our province but its many profound purposes and sound theories can be realized only upon meeting the requirements outlined therein. Without them, it is feared that roads that are not efficiently and economically managed may compel the Commission to fix rates at a much higher level than what are otherwise sufficient in order to enable them to bring about a return to the property owners. That the public, which ultimately pays the rates, should entertain such a feeling is only too natural, especially so since the statement of Mr. Brandeis, which Professor Cunningham characterized as "dramatic", that the railroads could save *a million dollars a day* through the adoption of a new system of scientific management.[1] Therefore when the Transportation Act was about to be passed, Congress deemed it provident to have such requirements incorporated in the act so that the public will be protected against any possible abuses that might grow out of this rule of rate-making.[2]

The law thus places upon the Commission, among other things, a new obligation to pass upon the degree of honesty, efficiency and economy with which the railroads of the country are managed and operated. Considering the physical magnitude

1. Cunningham, William J. "Scientific Management in the Operation of Railroads", Quarterly Journal of Economics, May. 1911 p 563.

2. For congressional origin of these requirements, see appendix I.

of the American railroad system and the thousand and one factors that enter into the railroad operation, the task which the Commission has been called upon to perform is, indeed, a great one. The law requires the Commission to be informed of not only the managerial efficiency but also of managerial honesty and economy and reasonableness of expenditures. Honesty has to do with motives behind the management's inefficiency or uneconomy. It is not susceptible of mathematical measurement but is to be determined through investigations as occasion arises. Economy (reasonableness of expenditures included) is essentially a part of efficiency. This is efficiency in its broad sense. Efficiency in its narrow sense is that which is independent of economy. Efficiency in the former sense means to obtain the best result relative to the effort applied. Under normal conditions it is to the benefit of the public to have the transportation service produced with efficiency of the former kind.

But how is the efficiency in railroad management to be measured? What has the Commission accomplished in the way of enforcing the requirements of the law? Is present administrative agency adequate? It not, what improvement is desirable yet practicable? What is the Commission's administrative policy in the last five years regarding these requirements? In an attempt to answer these questions the following pages have been written.

II

MEASUREMENT OF EFFICIENCY

A railroad has two functions, namely, to render adequate transportation service to the public and to manufacture and sell it at a profit. On account of this dual nature of public utilities, the ideal efficiency of a railroad management requires 100% efficiency in service as well as 100% efficiency in operation. It may not neglect one to favor the other. The operation of an unprofitable passenger train must continue regardless of its effect

on cost or on earnings. The same might be said of fast or preferential freight trains running on fixed schedules. In the discussion of efficiency in railroad management, therefore, we must not overlook nor underestimate the effect of service standards required of the railroad by the Interstate Commerce Commission or the several State commissions upon the operating results. (It is assumed that the Commission in interpreting the operating averages is fully informed of this fact by its Bureau of Service and the Section of Efficieny and Economy. In our study, as in all other studies in economics, the relative increase or decrease of operating efficiency is ascertained by the assumption that other things remain equal.)

With service standards properly maintained, the function of a railroad management is so to correlate and marshal the entire railroad physical facilities and labor forces as to produce the best possible operating results in transporting passengers and freight, which are the main business of a railroad. Although the proper maintenance of way, structures and equipment, the proper handling of accounts and records and the manifold activities of many other departments are all essential for the successful and efficient working of the big railroad machinery, the central and basic activity of general and economic interest is that of moving traffic. Hence in the study of the efficiency in railroad managements our attention is chiefly directed to the study of the efficiency in transporting passengers and freight as revealed by the analytical study of authoritative railroad statistics.

Operating efficiency must not be confused with operating ratio, the rise or fall of which depends upon a number of factors such as the physical characteristics of a road, its traffic characteristics, the adequacy or inadequacy of maintenance, the level of wages and materials, and the operating efficiency. Operating ratio is the result of the combined effect of these factors and not the measure of operating efficiency or inefficiency, Therefore, as

an index of earning power, operating ratio has some value; but as an index of operating efficiency, it is misleading if not worthless.

Efficiency is the ratio of the number of units of work that is actually obtained as the result of a certain operation to the number of units of work that theoretically can be procured from such an operation. In other words, efficiency is the ratio of what *is* to what *ought to be*. Efficiency in railroad management means that given number of men or rather number of man-hours, and given number of miles of tracks, locomotives, cars, and pounds of coal, the transportation service units accounted for should bear the highest possible ratio to the transportation product units. The former is usually expressed in terms of ton-miles and passenger-miles and the latter in terms of train-miles, locomotive-miles and car-miles, these being the basic statistical units of operation.

As a unit of measuring operating efficiency, the ton-mile "recognizes no distinction as to the relative weight, bulk, value or other qualities of the respective commodities transported, whether they be perishables, silk or coal." In the same way, the passenger-mile does not tell whether it is the result of the passenger trains "conducted at medium speed in crowded local trains with ordinary equipment, or in high-speed trains equiped with sleepers, parlor-cars, observation-cars, dining-cars, occupied by but few passengers in proportion to the weight of the train, and cared for by porters, cooks, waiters, barbers and stenographers".[1]

The Committee on Statistical Inquiry of the American Railway Association proposed a new unit in the "equated ton-mile" which is defined as "the sum of the weight of the car and lading and an allowance for the resistance offered by friction, grades and curves, multiplied by the mileage of the car".[2] Harrington

1. Haines, H. S., "Efficient Railway Operation" p 462
2. Ibid p 460

Emerson, efficiency engineer and author of the estimate upon which Mr. Brandeis based his "dramatic statement" mentioned above, proposed yet another unit for measuring operating efficiency of locomotives in the "equated locomotive day" which is defined as "a locomotive of average tractive power which makes an average number of miles".[1] In England, ton-mile and passenger-mile are not widely accepted. The general practice is to express the results of operation in average gross receipts per train-mile. A study has been made by the Railway Accounts Committee of that country as to the relative advantages and disadvantages of the ton-mile unit. The general conclusion drawn by the Committee from the evidence gathered on this point is that "as a measure of efficiency, statistics with regard to the average train load (of which ton-mile is basic) give information which is not afforded by the figures showing the average receipts per train-mile". The Committee added that "This must not, however, be understood to depreciate in anyway the value of the train-mile figures, as the load per train-mile and the receipts per train-mile relate to two distinct phases of railway business, neither of which can claim the right to usurp the province of the other".[2] Theoretically speaking, an ideal unit of measuring operating efficiency should embody at least five elements, namely, weight, distance, bulk, character and value of the commodity carried. But in so complicated a business as that of a railroad no all-embracing single unit is possible which will give a complete statistical photograph of the entire operating situation. Nevertheless, all the foregoing units, each representing one side of the truth, suggest that ton-mile, passenger-mile and train-mile are indispensable in any scheme of statistical method of measuring operating efficiency. They are by no means self-sufficient in

1. Emerson, Harrington; "A Radical Analysis of Railway Operation", Railway Review Vol. 68 May 14, 1921 p 729

2. "Report of The Railway Accounts Committee", Railway Gazzette Jan. 25, 1909 p 850

themselves, but they are basic. By correlating them to more specialized statistical units of the different operating elements and by interpreting them in the light of factors and conditions that are not susceptible of mathematical measurement, they are very helpful in the ascertainment of operating efficiency. Statistical data collected upon this basis are generally available and it is our purpose to study the changes in operating efficiency during the ten-year period from 1915 to 1924 as revealed by the changes in railroad managements' utilization of physical facilities and labor forces during the same period. The fiscal year of 1915 is being used as the base year chiefly for the reason that data on man-hours of railroad employees were begun to be collected by the Interstate Commerce Commission in that year.

III

THE GROWTH OF RAILROAD TRAFFIC.

The volume of railroad traffic responds sensibly to the alteration of business depression and prosperity which constitutes the business cycle. Professor Vanderblue has found that the movement of the railroad traffic curve is in harmony with the Harvard "B" curve which is the barometer of general business conditions.[1] The result of our own study is in exact accord with that of Professor Vanderblue's. Thus, the period under study from 1915 to 1924 which recorded three distinct business cycles is also marked by three wide fluctuations in the volume of railroad traffic. The peak traffic of 1918 coincides with the period of prosperity of the first cycle, and those of 1920 and 1923 coincide with the periods of prosperity of the second and third cycles respectively. Therefore, railroad traffic statistics are reliable recorders and the railroad traffic curve is an indicator of the country's general business conditions.

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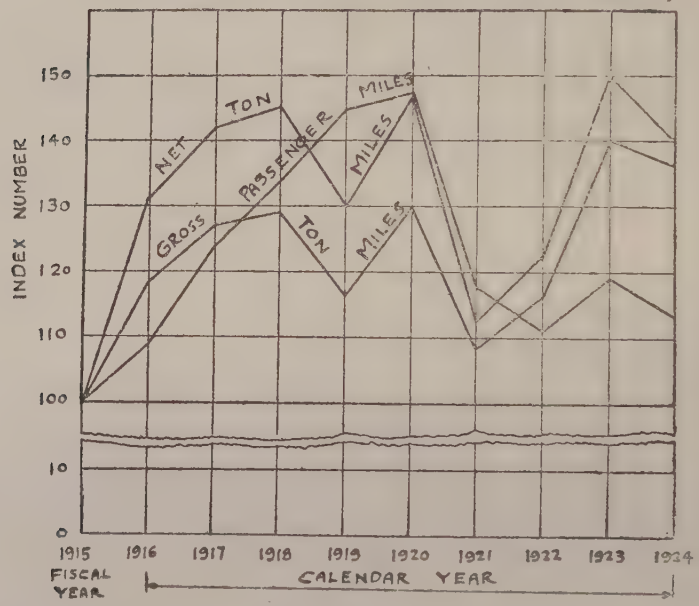
1. Homer B. Vanderblue, "Railroad Traffic and the Business Cycle", Railway Age Vol. 76 pp 783—6; 885-8; 987-90 March 22, April 5, 19, 1924.

Freight traffic as measured by net ton-miles (revenue and non-revenue) increased continually from 392,786,500,454 net ton-miles in 1915 to the first high mark of 449,001,713,665 net ton-miles in 1918, which is the peak of the first business cycle, a gain of 45% (see Chart I). War prosperity subsided in 1919 and

CHART I RAILROAD TRAFFIC CLASS 1 RAILROADS
(FISCAL YEAR 1915=100. SUPPORTING DATA TABLE I)



traffic fell to 30% above 1915. Business activities, however revived in 1920 and freight traffic reached its second high mark being 447, 278, 209, 869 net ton-miles, which is the peak of the second business cycle, an increase of 47% from 1915, which was slightly higher than the first high mark reached in 1918. Then business depression set in and traffic fell off considerably in the two following years due to world economic conditions and the coal and shopmen's strikes. The year 1923, which marked the peak of the third business cycle, was a superlative year in the history of

railroad operation. The amount of freight traffic carried was 50% more than that of 1915, a record yet to be broken. Freight traffic in 1924 was 40% more than that of 1915 and was the best since 1920 with the exception of 1923.

Passenger traffic has not increased at the same rate as freight traffic has, if we take the trend of the whole period into consideration. Largely due to troop movements, the passenger traffic was 24% greater in 1917, 34% greater in 1918, and 45% greater in 1919 than in 1915. Passenger-miles reached its climax in 1920, being 46,848,667 989 or 47% more than that of 1915. This unprecedented passenger traffic can be explained partly by the fact that 1920 was a year of great business activity which creates more frequent business traveling, and partly by the demoblization of troops and the return of American troops from the European theatre of war. In spite of the greatest freight traffic in 1923, passenger traffic was only 19% more than in 1915. In 1924, it was 13% more than in 1915.

A close study of the trend of curves in Chart I reveals two interesting points. In the first place, we observe that the gross ton-mile curve runs parallel with that of the net ton-mile curve but at a varying degree in different years. Since railroad operating revenue is derived from carrying the net load and railroad operating expenditure is incurred in carrying the gross load, the less the rise in the per cent of the gross ton-mile curve in proportion to the rise in the per cent of the net ton-mile curve the better for the railroads, therefore, the relative behavior of the two curves is a valuable indication of increased or decreased efficiency in operation. Notice the great distance between the corresponding points of the two curves in 1917, 1918, 1919, and 1920. This favorable showing was obtained, with the exception of 1920, by reason of war emergency when rolling stock was at a premium and movement of war supplies and exports assisted in making heavier car loading and train loading possible. By the same test,

it is clear that the economic production of revenue transportation service was much less from 1921 to 1924 than from 1915 to 1920. The second interesting point about the behavior of these curves is that the rise or fall of the passenger-mile curve usually lags behind that of the net ton-mile curve indicating perhaps the dependent character of the passenger traffic upon the freight traffic and also indicating perhaps the business habits of the people in extending credit at first and then going about to make collections or settlements.

Up to 1918, railroad traffic increased considerably as measured both by net ton-mileage and passenger-mileage, chiefly due to war conditions. Since then, only normal increase was made with two sharp drops in 1921 and 1922 for reasons previously mentioned. But how have the railroads been able to handle this increased traffic? It can be done by either more intensively utilizing their existing physical facilities and labor forces or by enlarging or adding to the number of existing units of them or by both.

IV

RAILROAD FACILITIES AND THEIR UTILIZATION

In the study of railroad traffic in the preceding chapter, mention has been made of the close relationship existing between the business cycle and railroad traffic. Now in this and the following chapter, we shall see that the business cycle exerts a direct influence upon the manner in which railroad facilities and railroad labor forces are utilized. In other words, the business cycle influences directly railroad efficiency. In a period of expanding business, railroad traffic increases frequently to an extent which tests the ability of the railroads to move the tonnage offered without delay and even congestion. But during business depression, railroad facilities are no longer utilized to their full capacity, since the demand for railroad service falls off with the

decline in business activities.[1] The operating averages are either raised or lowered as the case may be.

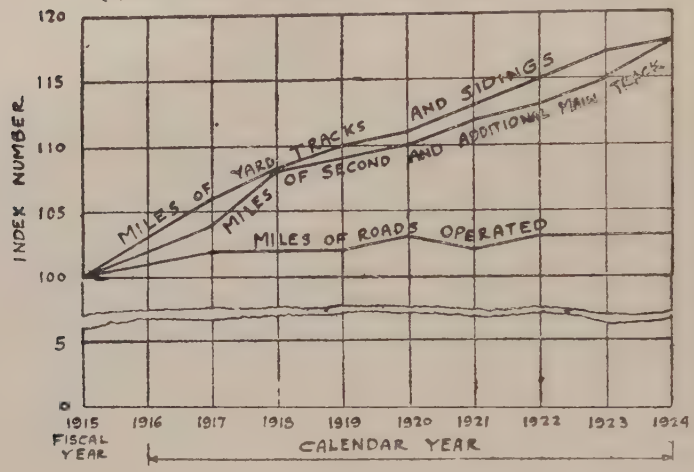
The business cycle affects labor utilization in the same way. In periods of boom, the management finds it increasingly difficult to perform its functions properly. Reorganization of force is usually necessary and such reorganization is usually attended by throwing the different productive factors out of balance. And the working force is usually enlarged by "new" men. On the other hand, when business depression sets in, the force is reduced and only the most productive laborers are retained. Thus, under the influence of the business cycle, the per man-hour product is either lowered or raised.[2] Therefore, in the study of the utilization of railroad facilities and railroad labor, our attention is constantly called to the influence exerted by the business cycle as well as other factors that might be involved.

Railroad facilities are of two kinds, the movable and the unmovable. To the former belongs locomotives and freight and passenger cars ; to the latter belongs the road-bed, tracks, bridges and buildings and structures of all kinds. In our attempt to ascertain the extent of the contributions made by the railroad facilities in moving the increased traffic since 1915, the changes in the unmovable or fixed railroad facilities will be first studied. Fixed facilities that directly concern transportation, the moving of traffic, are roadway and tracks (assuming the number of buildings and bridges etc. increase in proportion to miles of roadway and tracks). Statistics on railroad tracks show that there has been only a slight increase in the mileage of road operated during the ten-year period under study. The miles of road operated in 1915 were 228,989.03 and were 235,839.16 in

1. Ernest T. Trigg, "The Business Cycle as a Factor in Production Efficiency." Chemical and Metallurgical Engineering August 30, 1922 p 428.

2. John W. Reigel, "The Appraisal of Labor Efficiency" Harvard Business Review Vol. I pp 342-54.

CHART II. RAILROAD TRACKS, CLASS 1 RAILROADS
(FISCAL YEAR 1915=100, SUPPORTING DATA TABLE II)



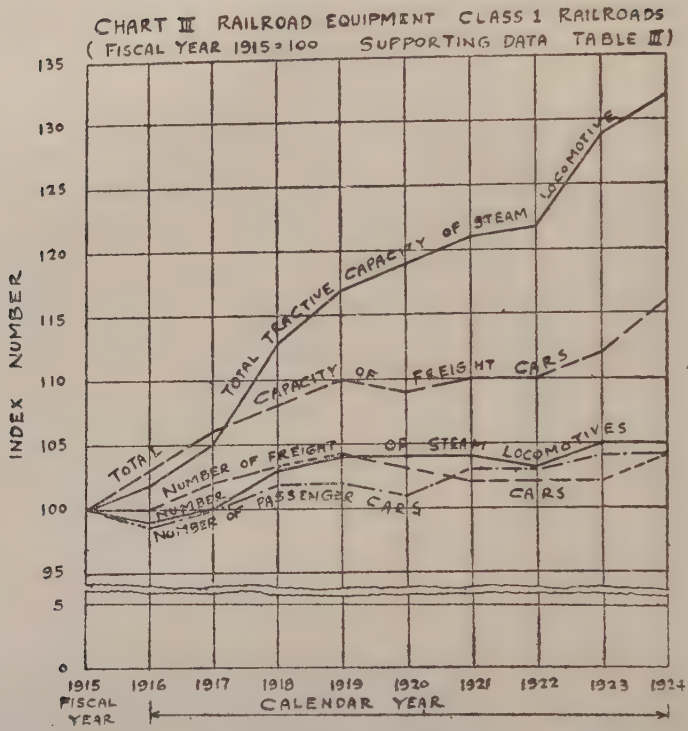
1924, an increase of only 3% (see Chart II). As measured by the comparison of per cent increase in traffic throughout the period and the increase in the miles of road operated, railroad fixed facilities have been much better utilized since 1915 than before, especially during the war period. But the increase in the mileage of second and additional main tracks and in the mileage of yard tracks and sidings, especially the latter, are comparatively greater. The mileage of second and additional main tracks increased from 33,435.85 in 1915 to 39,606.52 in 1924 or 18%. The mileage of yard tracks and sidings increased from 95,094.78 to 112,247.25 in 1924 or 18%. The larger part of these increases in second and additional main tracks and yard tracks and sidings was made after 1918 from 108% to 118% in 1924. The increase in traffic, on the other hand, was largely made before and in 1918. As measured by the comparison of per cent increase in second and additional main tracks and yard tracks and sidings and of per cent increase in traffic, railroad facilities were less utilized since 1918, due consideration being

given to the fact that railroad facilities once installed are to stay despite of seasonal fluctuations in traffic and business cycles which took place from year to year.

One of the largest fields of economy lies in yard operation. Any improvement toward bettering yard operation materially lengthens the life of the average car and the number of cars in service and is, therefore, highly commendable. As revealed by the trend of curves representing the increases in track facilities other than main tracks in recent years, the railroad managements fully realized or recognized the great importance of this fact and have continually enlarged them in order to expedite the movement of trains through yards, the "grave-yards of cars," and intermediate terminals and also to speed up road movements by reducing the number of times to side-track trains en route, resulting in better and more economical train operation. In its round trip of 14 9 days, the average car is on the transfer or yard tracks 9.2 days, or 61.7% of the time, according to Loree's estimate [1]. Then too, if the operation could be so organized as to require a smaller number of car movements in the yard and if the road movement could be so arranged as to minimize the necessity of handling cars in yards, great economies would be realized. As Professor Johnson said that "the speed with which the traffic can be handled in the yards determine more than any other single factor the efficiency of the railroad" [2]. Statistics on tracks only tell us in plain figures that the mileage has been increased but they do not reveal to us the improvements made by the railroads in rearranging and remodelling the layout of yard tracks which no doubt have contributed to the roads' ability in handling the increased traffic.

Like the fixed facilities, the movable railroad facilities increased but slightly in the ten years so far as the number of

1. Loree, L. F. "Railroad Freight Transportation" p 263
2. Johnson and Van Metre "Principles of Railroad Transportation" p 76



units are concerned as shown in Chart III. The number of locomotives increased from 61,883 in 1915 to 65,006 in 1924 or 5%; the number of freight cars increased from 2,258,855 in 1915 to 2,348,676 in 1924 or 4%; and the number of passenger cars increased from 52,690 in 1915 to 55,042 in 1924 or 4%. But the increase in tractive capacity of locomotives and the carrying capacity of freight cars on the other hand has been comparatively greater as shown by the two upper curves in the chart. The total tractive capacity of locomotives increased from 1,970, 295,300 pounds to 2,592,993,685 pounds in ten years, a gain of 32%; and the average tractive capacity of a locomotive increased from 31,839 pounds in 1915 to 39,735 pounds in 1924, a gain of 24% (see Table III, Appendix III). The great increase in the

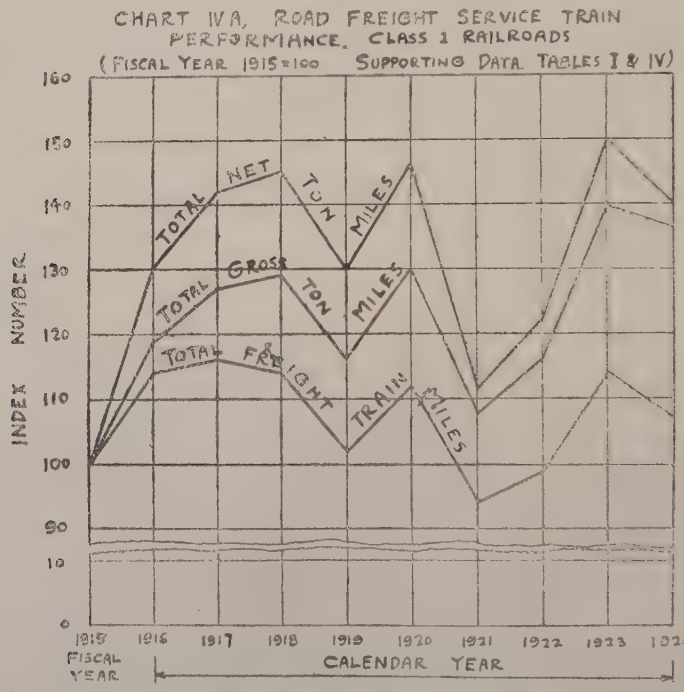
tractive capacity of locomotives was one of the most responsible factors in the railroads' achievement since 1915 in hauling larger and heavier train loads.

The total carrying capacity of freight cars likewise increased from 89,837,847 tons in 1915 to 104,148,002 tons in 1924, a gain of 16%; and the average hauling capacity of an average car was 11% greater, being 40 tons in 1915 and 44.3 tons in 1924 (see Table III Appendix III). This explains the reason why the railroads have been able to handle 40% increase of traffic with only 4% increase in the unit of equipment. Of course, without the cooperation of shippers in loading cars more fully to their capacity or in speedier unloading cars, the mere increase in the hauling capacity would mean little. The number of passenger cars increased also but slightly being 4% more in 1924 than in 1915. As measured by the number of units, the railroad movable facilities have been much better utilized in recent years, but not so when measured by the tractive capacity of locomotives and the total carrying capacity of freight cars since 1918. From 1918 to 1924, the former increased from 117 to 132 and the latter from 108 to 116, while the net ton-mileage actually decreased somewhat and therefore the equipment was less utilized. No doubt, the policy of the railroads is to enlarge the capacity of their equipment in anticipation of both the normal increase in traffic and peaks of business cycles. In the following paragraphs, an analysis is made of the manner in which railroad facilities have been utilized in moving passengers and freight.

1. Road Freight Service—Train Performance.

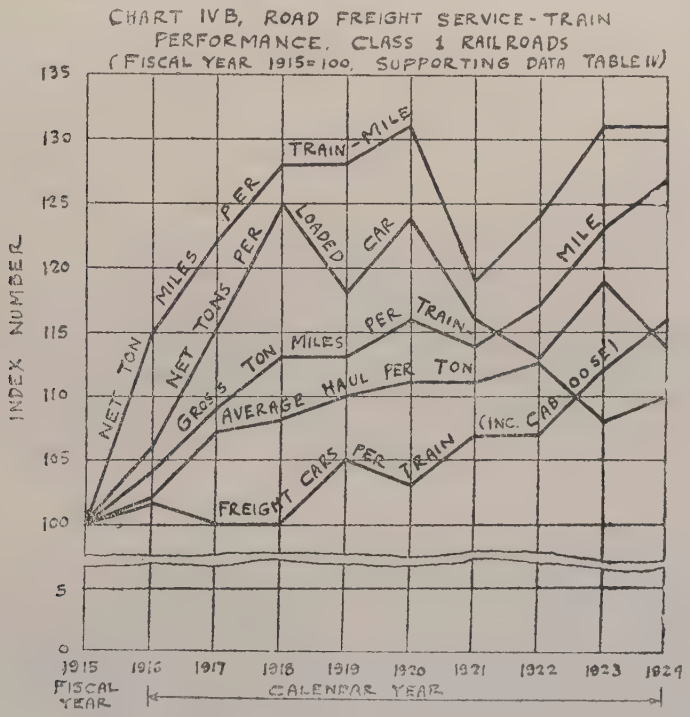
James J. Hill used to say: "We manufacture train-miles, we sell ton-miles." From the former railroads incur their expenses and from the latter they earn their revenues. The operating department is charged with a given number of train-miles and is credited with a given number of ton-miles and passenger-miles which they produced. Therefore the change in the relation

of the number of train-miles to the number of ton-miles, in the case of freight service, and that of passenger-miles, in the case of passenger service, is a valuable index of operating efficiency. Two indices are used in freight service for the purpose of pointing out this relationship, namely, "gross ton-miles per train-mile" and "net ton-miles per train-mile." The former represents the gross load of the train, the total weight behind the locomotive and its tender. It is the work done. The latter represents the



net load of the train, the revenue producing part of the load (when company freight is excluded). Statistics on fright train performance, as pictured in Chart IVA, during the ten-year priod under study indicate that great improvements have been achieved by the railroads in both the gross train-load and net train-load. The increase in train-miles has been at a much smaller proportion to the increase either in net ton-miles or in gross ton-miles. The

result of this very favorable relationship between the train-mile curve and the ton-mile curves was the increased train-load, gross and net, as shown in Chart IVB. Most of the increase in train-load was, however, made either before or in 1918. Since then, only slight or no increase was made. In 1921 and 1922, there was actually a decrease in net train-load. To what extent this was due to the absence of war conditions and to what extent this was due to improvements



in service in the form of more frequent and regular freight trains is difficult to state. But their influence is safe to be assumed. The gross train-load in 1924 was 1587 tons as compared with 1250 tons in 1915, an increase of 27%. The net train-load in 1915 was 539 tons, while in 1924, it was 711, an increase of 31%.[1]

1. Trains can not always be loaded to the full capacity of the locomotives, the potential train-loading, because some kinds of traffic

These increases in gross and net train-loads before 1918 were made possible by similar favorable operating results of three factors, namely, the length of the average freight train, the load of the average freight car, and the haul of the average ton of freight. The upward trend of all these three factors is readily noticeable in Chart IVB. The average number of cars per freight train in 1915 was 35.7. In 1924, it was 41.7, an increase of 16%. The continually upward trend of this curve clearly indicates the managements' policy to operate longer and longer trains. Since 1918, the upward movement of the car loading curve was checked. Although the average load per loaded freight car increased from 23.5 tons in 1915 to 26.9 tons in 1924 or 14%, much greater load had been obtained in previous years either due to war conditions which put a premium on cars or due to a campaign for greater car loading by the management as it was the case in 1923. But car loading is but one of the factors affecting car utilization and is not the sole denominator of car utilization as we will presently show. The average haul per ton of freight increased from 162.59 miles in 1915 to 178.85 miles in 1924 or 10%. As some of the operating expenses are not variable with the length of haul, the increase in average haul is highly desir-

require much faster movement than others. The nature of the traffic itself, in many cases, compels more or less rapid movement—live stock and perishable freight, for instance. For an individual railroad, the geographical situation of the line, with reference to other roads with which it exchanges traffic, the location of industries, etc., to a very large extent affects the economy of operation. Where a railroad enjoys an extra long haul or the bulk of its traffic, as is the case with the so-called "bridge lines" (the New York, Chicago and St. Louis is a partial example) much better operating averages of many kinds can be obtained than on a road like for example, the New York, New Haven and Hartford, which might almost be fairly compared to a vast switching yard, so numerous are its branches, industrial districts, short locomotive districts, and so on. Therefore, the "wholesale" nature of traffic in the former case and the "retail" nature of traffic in the latter case are important factors that should be taken into consideration in any analysis of railroad operation.

able for economical operation. Increasing efficiency in train loading thus has enabled the railroads in the United States to take care of the 40% increase in freight traffic in 1924 with only 7% increase in freight train-miles.

But true efficiency is not revealed unless we take into consideration also the time element—the train-hours. For a train may pull a greater number of cars and heavier load but at a much reduced speed, which means additional labor cost especially after the establishment of overtime and punitive rates. The unit that takes both load and speed into consideration is "ton-miles per train-hour". This unit "is analogous to the horsepower unit. It combines in itself the net effect of the operating policy between the two extremes of loading the locomotive to every ton it can drag at low speed over the ruling grade (operating efficiency pure and simple), and of sacrificing tonnage in order to make the trip quickly usually resulting in better service. There is always a critical point between the two extremes which under normal conditions will produce the maximum of ton-miles per train-hour at the minimum cost per ton-mile. Within economic limitations managements may be induced to sacrifice operating economies for better service to the public.

"To illustrate: assume that on a given run there are sections of 1 per cent grade over which a given type of locomotive can haul 1,500 gross tons (tons of car and lading combined) at a speed of six miles per hour on these maximum grades. The speed on other sections, of course, will be greater, but we will assume that, with a normal allowance for road delays, the run of 100 miles may be made in 10 hours. At that speed the production would be 15,000 gross ton-miles per train-hour (train-load of 1,500 gross tons times train speed of 10 miles per hour). As the train- and engine-crews are on an eight-hour day basis, they would be paid overtime for two hours. (It is not necessary here to go into the technicalities of the wage schedules which provide that mileage rates apply unless the miles per hour in freight

service are less than 12.5, in which case hourly rates, based on 12.5 miles per hour, apply.) In this case it may be found that a reduction in the tonnage rating to 1,350 tons would permit an increase in the speed and reduce the trip hours to 8, or an average speed of 12.5 miles per hour. This combination of train-load and train-speed will produce 16,875 gross ton-miles per train-hour. The ton-mile production per train-hour is thereby increased from 15,000 to 16,875, and the cost per ton-mile is decreased because of the elimination of overtime. In this assumed case it is plain that the 1,500 ton rating is uneconomical. In the great majority of cases it may not be clear whether there would be any real economy in decreasing the load to increase the speed. These principles are ordinary considered when the tonnage ratings are established, and it is the intention that they shall be set at a maximum which will not prevent the trains from moving at uneconomical speed".[1] In making up its decision, the management is influenced by the consideration of the desirability of improving services in spite of the uneconomical speed.

Data on train-hours are not obtainable before 1920, but from those available, it seems that the relation between train-hours and train-miles or between the speed and load and the general operating policy of the railroads can be fairly ascertained. The following data[2] throws very interesting light upon the operating efficiency of the railroads in the United States. In 1920 there was the record peak of traffic in the history of American railroad, the

YEAR	TOTAL FREIGHT TRAIN-HOURS		GROSS TON-MILES PER TRAIN-HR.		NET TON-MILES PER TRAIN-HR.		FREIGHT TRAIN MILES PER TRAIN-HOUR (SPEED	
	NUMBER	INDEX	No	IND.	No.	IND.	No.	INDEX
1920	61,500,854	100	14,876	100	7,272	100	10.3	100
1921	45,949,610	75	14,378	97	7,411	102	11.5	112
1922	50,269,316	82	16,187	108	7,399	102	11.1	108
1923	58,896,556	96	16,763	113	7,746	106	10.9	106
1924	52,239,512	85	18,249	123	8,172	112	11.5	112

(Monthly report of Operating Statistion, I. C. C.)

1. Cunningham, William J., "American Railroads" pp 384-85
2. Computed from monthly reports of Operating Statistics, I.C.C.

average train speed was 10.3 miles per hour with an average gross train-load of 14,876 tons and a net train-load of 7,272 tons. In 1921 traffic was light and therefore roads maintained a higher train speed at 11.5 miles per hour, an increase of 12%. Following this reasoning, we should expect a lighter train-load in 1921 than in 1920. This was so, as the gross ton-miles per train-hour decreased 3% from 14,876 in 1920 to 14,378 in 1921. Net ton-miles per train-hour, however, incressed 2% from 7,272 in 1920 to 7,411 in 1921. But in ascertaining the effect of the load of the train upon the speed and vice versa, gross ton-mile and not net ton-mile is the denominator. In 1922 gross ton-miles per train-hour increased 11% and train speed decreased 4% as compared with that of 1921. In 1923 the gross ton-miles per train-hour increased 5% as compared with that of 1922 and was followed by a 2% decrease in train speed. In 1924, however, there was a unique situation in the relationship of these two operating elements in that inspite of the fact that gross ton-miles per train-hour increased 23% from 14,876 to 18,249, the train speed was not lowered but on the contrary increased to 11.5 miles per hour or 12%. If our generalization that train speed varies inversely as the gross load of the train is correct, then the operating result of the railroads in 1924 indicates a double gain in both load and speed of freight trains and therefore a clear case of efficiency in operation.

2. Road Freight Service - Car Performance.

In the discussion of the increased train loading, we have briefly touched the car loading as one of the three great factors that affect freight train performance. Now we propose to analyse it more fully. There are four statistical units in the measurement of efficiency in freight car utilization, namely, the number of net tons per loaded car (the car loading), the percentage of loaded car-miles to total car-miles, the number of car-miles per car-day, and the number of net tons carried per car-day.

Car Performance - Class I Railroads[1]

YEAR	NET TONS PER LOADED CAR		% of LOADED TO TOTAL CAR-MILES*	% of LOADED EAST BOUND	CAR-MILES PER CAR-DAY	NET TON-MILES PER CAR DAY	% BAD ORDER CARS TO TOTAL	% of STORED CARS TO TOTAL ON LINE, DAILY
	No.	INDEX						
1915	23.5	100	64	—	—	—	—	—
1916	25.0	106	68	—	—	—	—	—
1917	27.0	115	68	—	26.1	—	5.6	—
1918	29.3	125	65	—	24.9	487	5.7	—
1919	27.6	117	67	—	23.0	441	7.1	—
1920	29.1	124	66	58.8	25.1	498	7.0	6.761
1921	27.3	116	61	59.9	22.4	389	13.1	1.968
1922	26.6	113	65	59.7	23.5	424	12.8	6.355
1923	27.9	119	64	59.5	27.8	510	8.0	10.854
1924	26.9	114	63	59.5	26.9	472	7.8	.630

*This percentage will be from one to two per cent higher if we exclude cabooses in the computation of total car-miles.

(1) Net Tons Per Loaded Car although increased from 23.5 in 1915 to 26.9 in 1924, a gain of 14%, much larger increases had been made in 1917, 1918, 1919, 1920 and 1923. These increases were made possible partly by the increase in the average carrying capacity of freight cars (see Chart III) but its per cent increase was much smaller than the per cent increase in car loading. Efficiency in car loading and cooperation of shippers in the case of 1923 were largely responsible for this favorable car performance. From chart IVB on page 17, we observe that the car loading curve reached its highest mark in 1918 and after that it assumed a downward tendency, indicating the reduced utilization of freight cars. (The influence of business cycles is clearly indicated in the chart.)

(2) The Percentage of Loaded Car-miles to Total Car-miles largely depends upon the balance of traffic. Take the country as a whole, about 60% of the loaded car-miles are East bound, carrying agricultral and mine products from the West to the Eastern cities. The effect of the movement of these two classes

1. Computed from monthly reports of Operating Statistics, I. C. C.

of commodities upon the balance of traffic can be readily seen if we compare the percentage of loaded car-miles East bound with the percentage of commodities carried by classes as shown in the following table. In 1921 we notice that there was 3.41%

Percentage of Commodities Carried by Classes

YEAR	AGRICULTURE	ANIMAL	MINE	FOREST	MANUFACTURE	L.C L. & MISC.
1915	10.82	2.37	53.68	8.61	16.77	7.75
1916	10.69	2.41	53.00	8.64	17.30	7.96
1917	9.57	2.43	53.54	8.96	17.29	8.21
1918	9.90	2.66	54.76	8.35	16.36	7.97
1919	11.20	3.03	50.95	9.17	17.40	8.25
1920	9.76	1.99	53.64	8.68	21.94	3.99
1921	13.17	2.47	51.94	8.76	19.69	3.97
1922	11.99	2.44	49.56	9.30	22.91	3.80
1923	9.45	2.09	53.58	9.54	22.19	3.15
1924	10.63	2.23	51.33	9.64	23.04	3.13

(Statistics of Railways in U. S. I. C. C.)

increase in agricultural products and .48% increase in animal products with a decrease of 1.70% in mine products as compared with 1920. Taking the last one from the sum of the first two figures we have a net increase of 1.19% in commodities moving Eastward. We also notice that manufactured goods, which being usually Westbound, in the same year had a decrease of 2.25% from the previous year. This means that the roads in the country in that year had that much less traffic to utilize their home bound empty cars (Westbound) in addition to the increase in empty movement caused by the 1.19% increase in the East bound traffic. These combine to explain the 5% decrease in the percentage of loaded car-miles to total car-miles (being 66% in 1920 and 61% in 1921) which is the same as a 5% increase in West bound empty movement.[1] In 1922 there was a combined decrease of 3.56% in agricultural and mine products carried and a 3.22% increase in manufactured goods carried to offset it. Hence the

1. The volume of local traffic with its short hauls and frequent loading and unloading of cars also affect the empty car mileage.

perecentage of loaded to total car-miles was 4% higher. Figures for other years bear the same relationship. Therefore, in studying car performance, the balance of traffic is a very important desideratum. As shown in the table (page 22) this per centage reached its highest mark in 1916 and 1917. Since then, it was reduced.

(3) Car-miles Per Car-day is a very useful unit in measuring the extent of equipment actually engaged in road movement. This unit besides depending upon the train speed is influenced by the number of new cars purchased over those retired, and by the number of cars stored and by the percentage of bad order cars to the total on the line. Since in obtaining the number of car-miles per car-day, the number of all cars is used as a divisor,[1] therefore any change in any one of these three factors will have its effect upon this unit. Because of this fact, we see that in years of high percentage of bad order cars to total on line the number of car-miles per car-day is lower than other years. This is very noticeable in 1921 and 1922, the latter being the year of the

1. The following factors produce "car-days" in which there are no "car-miles":

1. Cars unserviceable
2. Cars stored (no demand for use)
3. Cars loading (at point of origin)
4. Cars unloading (at destination)
5. Cars in intermediate terminals not moving in road trains.

The management is not responsible for most of these factors. The management has little to do with factors 2 and 3 (except in the case of l.c.l. freight). The responsibility of the management in the 5th factor is only partial on account of "reconsignment," "to order" etc. and other privileges. The management may or may not be responsible for the number of unserviceable cars. In the first place, such an ideal state of affairs as having no bad order cars at all is practically impossible. Therefore, the measure of practical efficiency in this respect is to be found in the law of average. In the second place, while during periods of dull business it is a good policy to put all equipment in good order in anticipation of the demands of future traffic, sometimes the financial condition of the carriers prohibits carrying out this policy, and they have to compromise, so to speak, and only spend such money as they can afford to towards bringing their equipment up to a high state of efficiency.

shopmen's strike. However, we must always bear in mind that this is but one of the influencing factors. Sometimes the influence of one of them is balanced by that of the other factors, the number of stored cars for instance. Bad-order car condition was at its worst in 1921 and 1922. It has been much improved since then. The general trend of car-miles per car-day is on the upward movement as the figures in the table show. That is an indication of better utilization of equipment and hence increased efficiency in car performance. This is the only unit, so far, which has shown an increase since 1918.

(4) Net Ton-miles Per Car-day, "the final and inclusive unit of freight car efficiency," is the resultant of the three foregoing factors or units, namely, net tons per loaded car, per cent of loaded to total car-miles, car-miles per car-day. "If, for example, the car load is 30 net tons, the per cent of loaded to total car miles is 70 per cent, and the car-miles per car-day are 30, the net ton-miles per car-day are 630 (car-load-30 tons—multiplied by per cent of loaded cars—.70—multiplied by car-miles per car-day-30). An improvement in any one factor favorably influences the inclusive unit; a loss in any one factor adversely affect it. If a campaign of intensive car loading brings about an increase of 10 per cent in the car-load to 33 net tons, but also causes a slowing up in car movement of 10 per cent to 27 miles per day, the road is not better off. In fact there is a slight loss, as the ton-miles per car-day will be 624 instead of 630. If, further, the heavier car loading increases the empty car movement, and thereby decreases the per cent of loaded car-miles to total car-miles, say to 67 per cent instead of 70 per cent, the inclusive unit—ton-miles per car-day—will suffer a further loss—597 instead of 630. The interrelation of these factors is often overlooked. From the single viewpoint of car performance there is no advantage in improving one factor if it is done at the expense of either or both of the other two factors."[1]

1. Cunningham, William J., "American Railroads" p 386

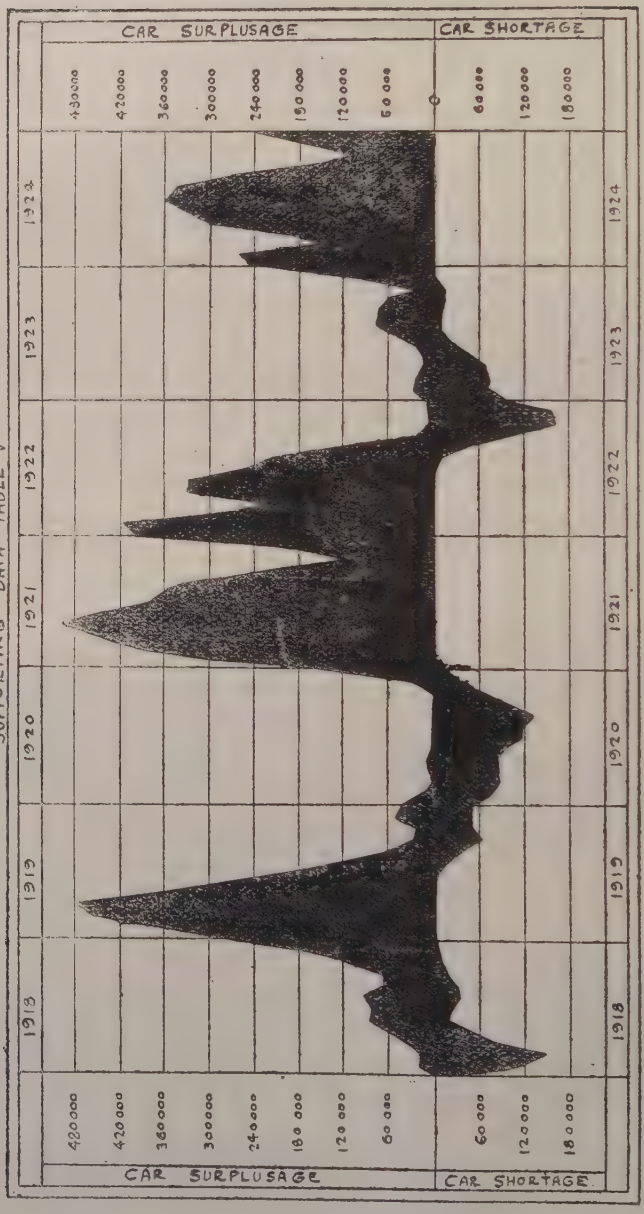


CHART V. CAR SURPLUSAGE AND CAR SHORTAGE
SUPPORTING DATA TABLE V

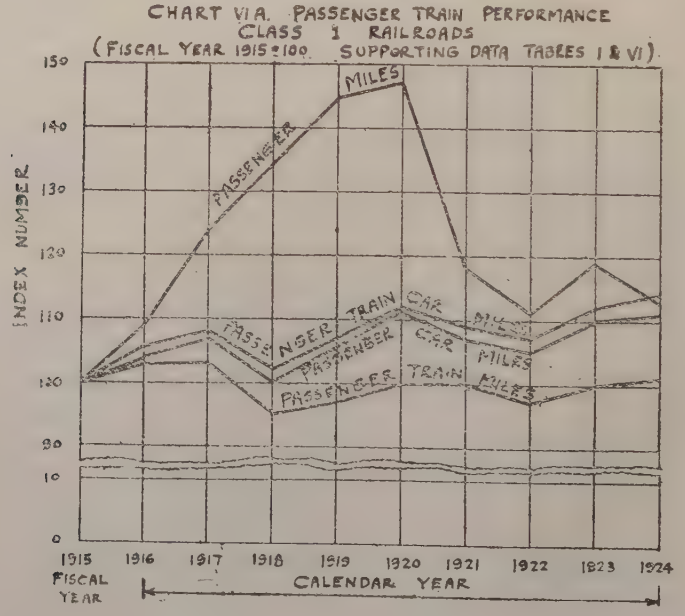
Data on this inclusive unit does not go back further than 1918. During this period the number of net ton-miles per car-day has fluctuated rather irregularly. The policy of railroads, as the figures in the table indicate, has been that of heavier car loading and to run trains at a greater speed. Given continuous favorable balance of traffic, there is little doubt that the inclusive unit would assume an uninterrupted upward trend. The figures also show that car performance reached its lowest efficiency in 1921 and its highest efficiency in 1923.

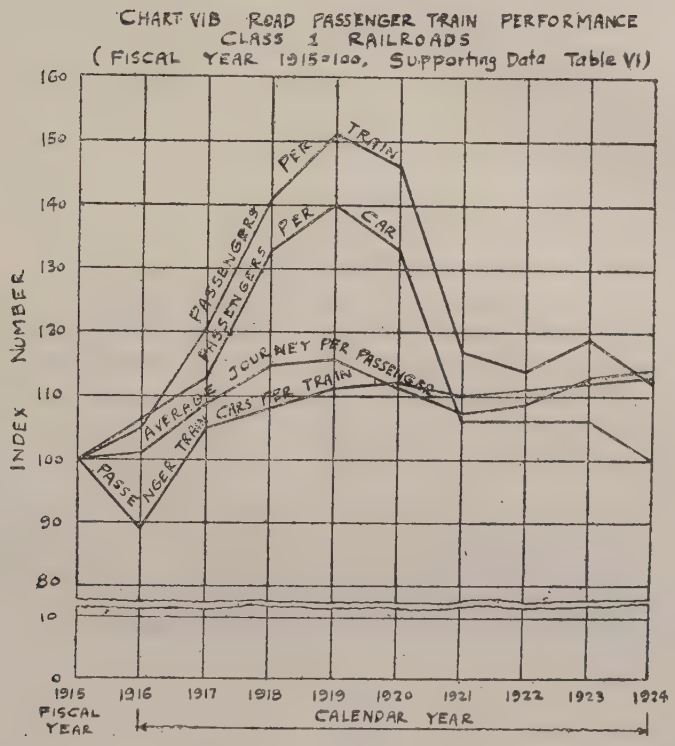
One additional index of ascertaining efficiency in freight train service in general and of car performance in particular is afforded by the return on car surplusage and car shortage. Car situation as represented by the changes taken place during the period from 1918 to 1924 is graphed in Chart V. The appearance of car shortage is closely related both to seasonal influences and to the effect of the business cycle on the demand for transportation. It seems that the cause of car shortage is the failure of the railroads to provide the extra equipment to take care of the peak load business. But this is not so. A solution of car shortage based upon this reasoning will prove to be both uneconomical and unscientific. The car performance as revealed by the very frequent appearance of car surplusage, this at a very large degree, and the less frequent appearance of car shortage, this at a much smaller degree, is significant. The real cause is the lack of efficient car distribution from the national standpoint, the lack of cooperation between the shippers and the railroads, and the lack of the knowledge of utilizing the relationship which exists between the business cycle and railroad traffic in forecasting future traffic and transportation needs. Fortunately, the cause has been lately recognized and the parties concerned have endeavored to act accordingly. The result is that in spite of the record traffic in 1923, especially during the period of peak load in the fall, no serious car shortage took place. Although the traffic in 1924 was not as heavy as that of the preceding year, the almost total absence of car shortage is really remarkable

from the operating point of view. To share this credit with the railroads are the Bureau of Service of the Interstate Commerce Commission, the Car Service Division of the American Railway Association, and the shippers in general for their cooperation.

3. Passenger Train Performance.

Railroad management has less control over passenger train performance than over the freight train performance due to the inflexible nature of the passenger train service to adapt itself to passenger traffic offered. Passenger trains are announced in fixed time tables and some are required to run by State commissions regardless of the amount of traffic offered. Therefore, unlike the freight train performance, the passenger train-miles curve does not fluctuate in the same manner as does the passenger-miles curve and remains almost constant, comparatively speaking, during the period under study (compare Chart VIA with Chart IVA. The improvements in service which the roads recently made, tend to modify this statements to some extent.)





Due to war conditions which were conducive to intensive utilization of equipment and due to the necessity of conserving motive power, passenger train-miles in 1918 and 1919 were less than those of the base year 1915, although passenger-miles were considerably increased. All this was brought about (1) by operating longer trains, the average number of passenger train cars per train in 1915 being 5.72 and 6.46 in 1924, an increase of 13% as shown in Chart VIB; and (2) by having greater number of passengers per train as well as per car, the number of the former in 1924 being 63 as compared with 56 in 1915, an increase of 12%. For the reasons already mentioned above, the curves of these units were much higher in the years preceding 1921.

Since 1920 the curves show that passenger-miles greatly reduced while passenger train-miles remained unchanged or changed but little. This reduced utilization is partly to be explained by the nature of the passenger service and partly by the competition of automobiles and motor buses, especially the former. A recent survey[1] covered a period of five years from July, 1921 to July, 1925, shows that although the number of commutation passengers increased, the number of all passengers carried declined from 90,841,000 in July, 1921 to 75,336,000 in July, 1925. The average journey of non-commutation passengers in July, 1921 was 54.54 miles, while in July, 1925, it had increased to 73.53 miles. These two facts are to explain that the bulk of the passenger traffic that has been lost has been short distance business outside of urban and suburban areas and that many local trains have been run without sufficient traffic to support them, resulting in the reduced number of passenger-miles per passenger train-mile.

4. Utilization of Motive Power.

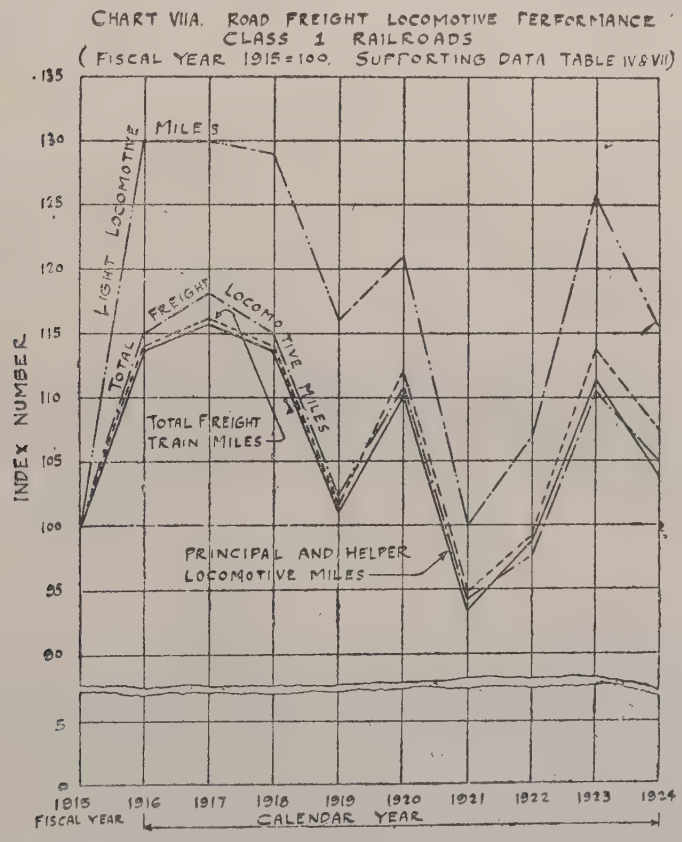
We have briefly mentioned that the increase in the total as well as the average tractive capacity of locomotives was one of the factors that have enabled the railroads in recent years to obtain better efficiency in train operation. In the following paragraphs we are going to discuss the manner in which the locomotives in the three classes of service, that is, freight, passenger and yard, were utilized in order to accomplish this.

(1) Road Freight Locomotive Performance.

Theoretically speaking, for each mile the locomotive runs there should be one train-mile produced by it. In practice, however, this state of affair can never be attained. This is chiefly due to the fact that certain per cent of locomotive-miles are necessarily run "light" in their outgoing trip to answer traffic needs at the other end of a division, in their return trip from "double-heading" to pull a "drag" over certain grade or

1. Railway Age, Editorial, Oct. 24, 1925. p. 738

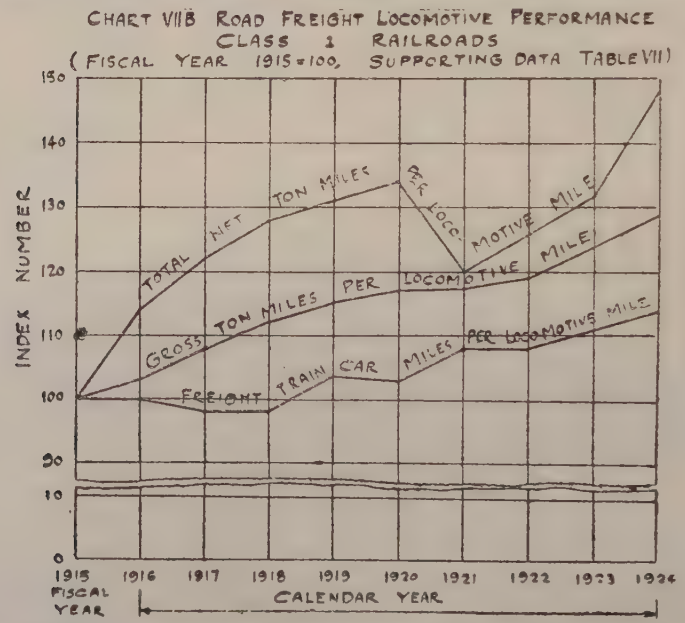
grades, and so on. It is to the credit of American railroads that in recent years they have been able to produce more per cent of freight train-miles with a less proportional increase in the per cent of locomotive-miles. As shown in Chart VIIA, since 1919, the total freight locomotive-miles curve has been either from



1 to 2 per cent less than the freight train-miles curve or has maintained the same per cent of rise or fall of the freight train-miles curve. This is clearly an indication of efficiency in the utilization of motive power in freight train service. In 1916, 1917 and 1918, we notice that the total locomotive-miles

from 1% to 3% higher than the total freight train-miles curve. This is readily explained by the excessive "light" locomotive-miles in those three years as shown by the "light" locomotive-miles curve in the chart. Notice also how principal and helper-locomotive-miles curve follows closely the freight train-miles curve.

With this increased efficiency in the utilization of freight locomotive-miles, it is only natural to expect to see an increase in the amount of work done as represented by such units as net ton-miles per locomotive-mile, gross ton-miles per locomotive-mile, and freight train car-miles per locomotive-mile. The increase in



these units is graphically represented in Chart VIIB. The upward trend of these curves is very noticeable. The gross ton-miles per locomotive-mile increased from 1,150.87 in 1915 to 1,488.72 in 1924 or 29%; net ton-miles per locomotive-mile increased from 425.42 in 1915 to 635.11 in 1924 or 49%; and

freight train car-miles per locomotive-mile increased from 32.35 in 1915 to 37.15 in 1924 or 14%.

Moreover, it is significant to note that fuel consumption for the four years for which data are available shows a decrease from 162 pounds per 1,000 gross ton-miles in 1921 to 149 pounds in 1924. Also, the per cent of unserviceable locomotives to total locomotives has become less and less, with the exception of 1922 on account of the shopmen's strike. Due value being given for the contributions made by improvements in mechanical devices installed in recent years, the better utilization of locomotives and their good condition are material factors in the increased operating efficiency accomplished in the last few years.

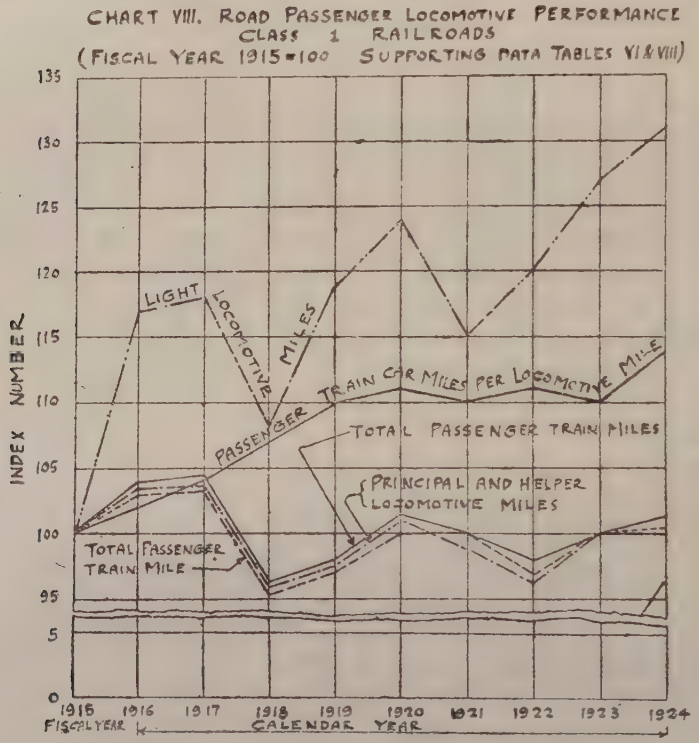
YEAR	POUNDS OF COAL PER 1,000 GROSS TIN-MILES	PER CENT OF UNSERVICEABLE LOCOMOTIVES TO TOTAL LOCOMOTIVES
1920	—	24.5
1921	162	24.0
1922	163	25.5
1923	161	21.6
1924	149	18.8

(Monthly Report of Operating Statistics, I. C. C.)

(2) *Road Passenger Locomotive Performance.*

The general principles governing road freight locomotive performance find similar application in the road passenger locomotive performance. During the last ten years the utilization of passenger locomotive-miles in producing passenger train-miles has also been that of increased efficiency. The per cent of increase, however, was slightly less than that in freight locomotive performance. In Chart VIII, we find that the passenger locomotive-miles curve has maintained the same per cent of fluctuation with the passenger train-miles curve except in 1918 and 1920. In those two years, it was 1% higher, indicating efficiency in the utilization of passenger locomotive-miles. In 1921 and 1924, we find that the total passenger locomotive-miles was 1% lower than the passenger train-miles curve and this was accomplished in face

of higher per cent increase of light locomotive-miles (see chart below), a further indication of increased efficiency in passenger locomotive performance. By virtue of this increased efficiency,



the number of passenger train car-miles per locomotive-mile increased from 5.61 in 1915 to 6.41 in 1924 or 14%.

YEAR	LOCOMOTIVE-MILES PER LOCOMOTIVE-DAY	POUNDS OF COAL PER TRAIN CAR-MILE	PER CENT OF UNSERVICEABLE LOCOMOTIVES TO TOTAL
1920	—	18.3	24.8
1921	—	17.7	23.1
1922	101.7	17.9	23.5
1923	108.0	18.1	20.8
1924	108.6	17.0	18.5

(Monthly Report of Operating Statistics, I. C. C.)

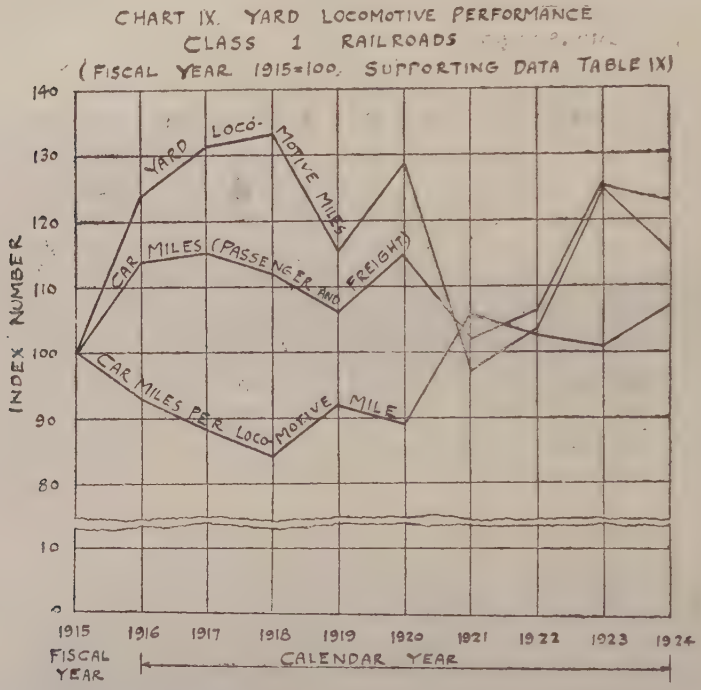
Increased efficiency in passenger locomotive performance is further shown by the decreased consumption of coal per train car-mile from 18.8 pounds in 1920 to 17 pounds in 1924. The condition of motive power in passenger service was best in 1924. In 1920 the per cent of unserviceable locomotives to total locomotives was 24.8%, in 1924 it was 18.5%, a decrease of 6.3%. Although mechanical improvements were an important factor in the economical use of fuel, the managements were responsible for their installation.

Further evidence of improvement accomplished in passenger locomotive performance is found in the increase of the number of locomotive-miles per locomotive-day, rising from 101.7 in 1922 to 108.6 in 1924, an increase of 7% inspite of the fact that the average load of an average locomotive as measured by the number of passenger train cars per train increased from 5.72 in 1915 to 6.46 in 1924, or 13% (see Chart VIB).

3. Yard Locomotive Performance.

In the measurement of efficiency of yard locomotive performance, the combined total car-miles (freight and passenger) are used as the sum and the total yard locomotive-miles the divisor. The number of yard locomotive-miles since 1915 has increased at greater percentage than the number of car-miles (freight and passenger) as shown by their respective curves in Chart IX, resulting in the decreased number of car-miles per locomotive-mile. This unit has been improved, however, since 1921, as indicated by the curve in the chart. The unfavorable operating condition in yard locomotive performance was chiefly due to operating characteristics peculiar to the yard operation. The yard has already been referred to as the "graveyard" of cars. As a rule, active traffic in the period of boom of the business cycle brings about congestion in yards for a number of reasons, such as increase in cars held for "reconsignment", "to order"; increase of cars waiting for delivery to connecting lines; increase in the

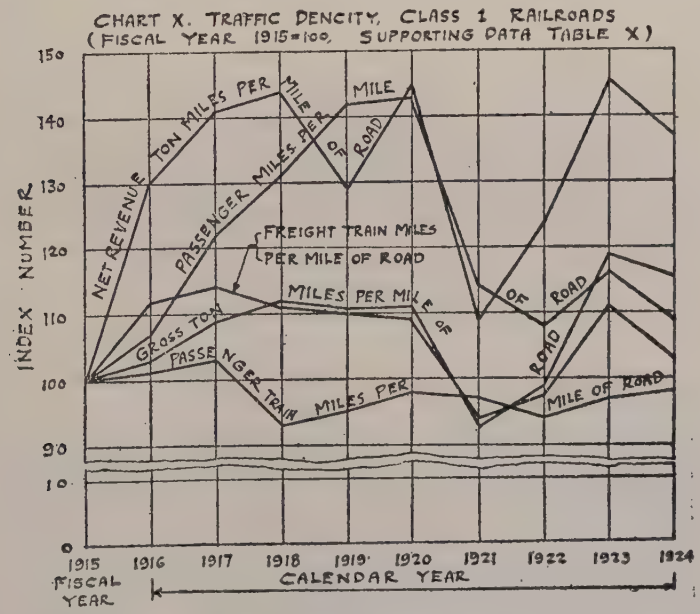
number of car movement in the making and breaking up of trains and so no. As evil begets evil, so any increase in these factors



causes disproportionately greater increase in the number of necessary car movements and therefore a disproportionately greater increase in the number of yard locomotive-miles. The trend of these curves in Chart X bears this out clearly and convincingly. The war years which marked the exceedingly active traffic were also years of exceedingly low per cent of car-miles per yard locomotive-mile. Notice how the lower curve in the chart falls and rises in the opposite direction with the two upper curves. In remedying this attending evil of active traffic, betterments, and additions in yard track facilities are the most important factors, although the skill with which yard operation is conducted is of supreme importance. The 18% increase in 1924 in the miles of

yard tracks and sidings (see Chart II) is probably the explanation for the improvement made by the roads in the number of car-miles per yard locomotive-mile.

Having acquainted ourselves with the extent of the utilization of the movable railroad facilities, we are now able to better restate the utilization of the fixed railroad facilities which has been discussed in some detail at the beginning of our study. The utilization of the railroad lines as a highway is perhaps best expressed by the index of *density of traffic*, that is, the amount of traffic carried by the railroads per mile of road operated. As shown in Chart X, the number of net tons of freight passed over the average



mile of road in 1924 was 37% greater than in 1915, and the number of passengers carried was 9% greater. But from the point of view of efficiency in operation, the freight train-miles and passenger train-miles per mile of road are the better indices as the number of train that can be operated safely over a given section

of the line determines the capacity of that section, rather than the number of tons or passengers that can be carried over it. Freight train-miles per mile of road in 1924 was 3% greater than in 1915 but passanger train-miles per mile of road was 2% less. According to the latter unit the lines of railroads were less utilized in 1924 than in 1915, but, according to the former unit, they were more utilized as shown in Chart X.

V

RAILROAD LABOR AND ITS UTILIZATION

In the year 1924, 21.89% of the railroad employees in the United States were employed in the Maintenance of Way and Structures, 31,10% in Maintenance of Equipment and Stores, 11.74% in Transportation (other than train, engine, and yard), 1.39% in Transportation (yard master, swith tender, and hostler), and 18.08% in Transportation (train and engine service). The rest, 16.80% was made up of executive officials, professional, clerical and general employees.[1] From the viewpoint of the railroad performance no other single group of employees has a more direct influence upon the operating efficiency than those employees engaged in train, engine and yard services, who actually move the traffic. Hence their utilization will be first studied.

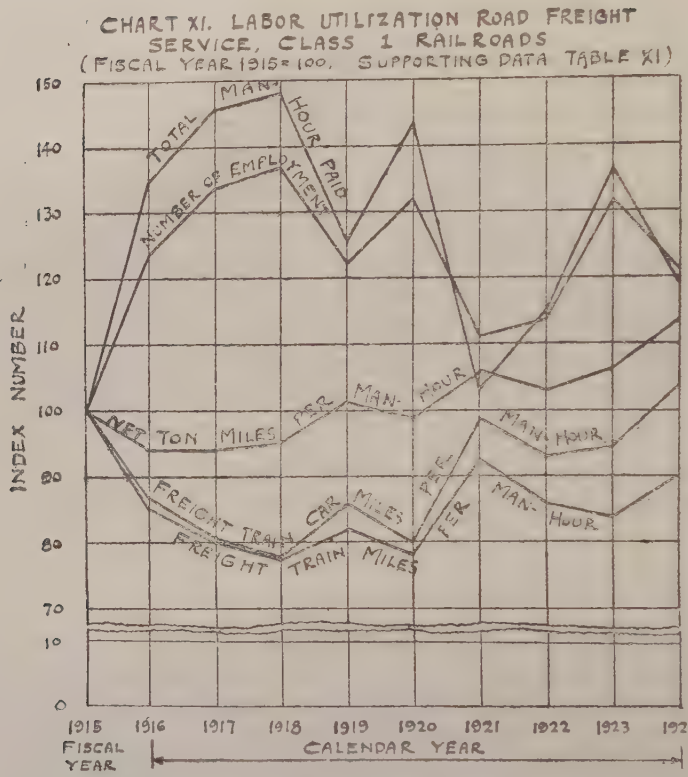
The number of employees engaged in train, engine and yard services has increased considerably since 1915, especially in the yard service. This increase was in a way the result of the Adamson Act of 1916 establishing the basic eight-hour day in train, engine and yard services. The force employed in road freight service was increased from 123,608 men in 1915 to 149,664 men in 1924 or 21%. This increase was much greater during the war years than in other years (see Chart XI). The labor force engaged in road passenger service was 13% greater in 1924 than in 1915 (see Chart XII). And the increase yard force was 67% in 1924 as compared with that of 1915 (see Chart XIII).

1. Wage statistics, Class 1 Steam Roads in U. S. I. C. C. 1924.

In measuring the efficiency in the managements' utilization of labor, however, the number of employees is not such an effective index as the number of man-hours paid for, which includes all the straight time actually worked, overtimes paid for at prorata rates, overtime paid for at punitive rates, and time paid for but not worked. The idea is that the extent of labor utilization is largely dependent upon the direction, supervision and organizing ability of the supervising officers and the payment of man-hours other than those actually worked reflects the degree of efficiency with which the labor has been utilized. The total number of man-hours paid for in road fright service was 19% greater in 1924 than in 1915; that in road passenger service and yard service was 27% and 29% greater. In the following paragraphs a separate study is made of the managements' utilization of man-hours in the several classes of service.

1. Labor Utilization, Transportation Service (Train, Engine, and Yard Employees)

(1) Labor Utilization, Road Freight Service. Labor utilization in road freight service is measured by comparing the total number of man-hours with the total number of ton-miles, car-miles and train-miles they produced. The total number of ton-miles and per man-hour was 6% less in 1916 and 1917 and was 5% less in 1918 than in 1915. After 1921, improvement was made in this respect, and in 1924 the number of net ton-miles per man-hour was 14% greater than in 1915. The number of car-miles and train-miles per man-hour had a similar unfavorable record of performance as shown by their respective curves in Chart XI appeared on the next page. Improvements, however, have been made in recent years as indicated by the upward trend of these two curves. Freight train-car-miles per man-hour in 1924 exceeded those in 1915 for the first time, a gain of 4%. But the number of freight train-miles per man-hour was still 10% below that of the base year.



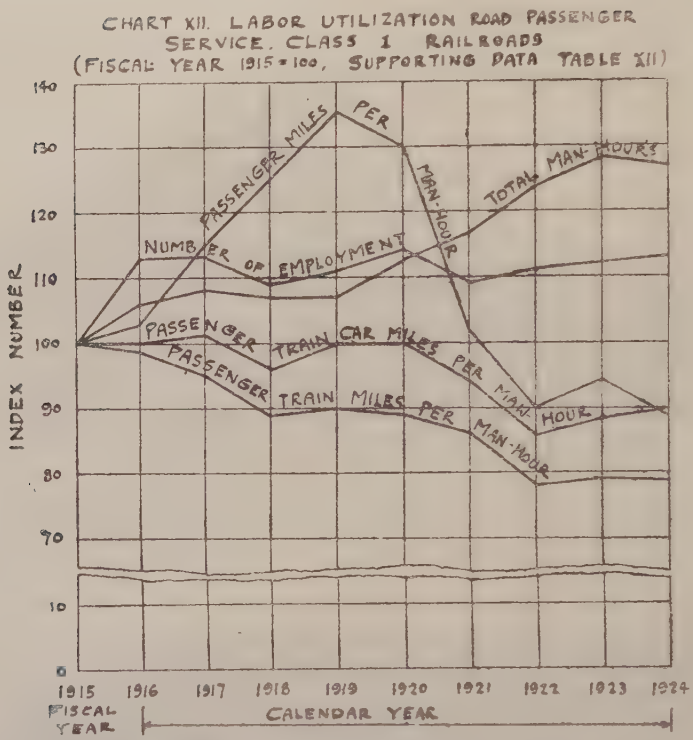
It is not unreasonable to assume, after due consideration has been given to the counter balancing influence of better locomotives put out in recent years, that this unfavorable operating result was partly due to the effect of the increase in the average train-load upon the speed of freight trains, thereby decreasing the number of freight train-miles per man-hour. Data on train speed goes back only to 1920 (see page **29**), but it is sufficient to prove the probablity of our assumption. Thus from 1920 to 1924, we notice that for every increase in freight train-miles per train-hour there follows a similar increase in freight train-miles per man-hour and conversely a fall in freight train-miles per train-hour is followed by a fall in freight train-miles per

YEAR	FREIGHT TRAIN-MILES PER TRAIN-HOUR	FREIGHT TRAIN-MILES PER MAN-HOUR
1920	10.3	1.24
1921	11.5	1.47
1922	11.1	1.38
1923	10.9	1.33
1924	11.5	1.44

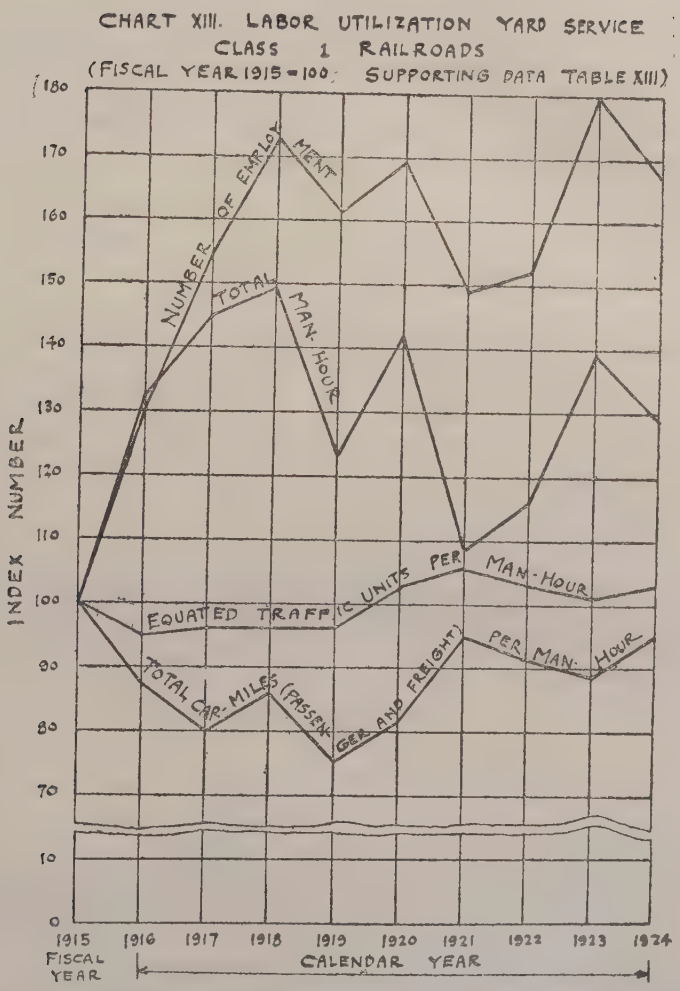
(Computed from basic data.)

man-hour. Therefore the very factors that effected increase in the production of ton-miles per man-hour, namely, heavier car loading and train loading, also worked to decrease the production of train-miles per man-hour. There can be no perfect gain in both of them and the gain in one of them will be largely obtained at the expense of the other. Necessity of traffic conditions and expediency in operation decide the management's policy as to which should have the priority.

(2) Labor Utilization — Road Passenger Service. Labor utilization in road passenger service is measured by a similar comparison between the number of man-hours and the amount of work produced by them, namely, passenger-miles, passenger train car-miles, and passenger train-miles. Like the utilization of railroad physical facilities, railroad managements have less control over the utilization of labor in passenger service for the reason that managements have less control in adapting service to traffic offered. War conditions brought the number of passenger-miles per train-mile from 219.70 in 1915 to 297.93 in 1919, an increase of 35%. But since then the trend has been that of a downward one, chiefly due to the passing of war influences upon the passenger traffic and the competition of automobiles. Effort to better adapt service to traffic and hence to check this unfavorable trend is indicated by the two curves respecting the passenger train car-miles and passenger train-miles per man-hour since 1922.



(3) Labor Utilization—Yard Service. In measuring the labor utilization in yard service, the number of equated traffic units (a combined unit of ton-mile and passenger-mile. One passenger-mile is made equivalent to three ton-miles on the theory that the revenue derived from one ton-mile is about one-third of a passenger-mile) and the total number of car-miles (freight and passenger) are used as the production and the number of man-hours as the divisor. Labor utilization in yard service as measured by the number of equated traffic units per man-hour has, since 1919, been favorable. In 1924 the per man-hour production was 3% greater than in 1915 as shown in Chart XIII. As measured by the number of car-miles per man-hour, labor efficiency in yard service has not been favorable. But improvements have been made since 1919, in that



year it was 25% below the base year. In 1924 it was only 5% below the base year. As the main duty of the yard service employees is to switch cars into and out of trains, to move them to and from transfer and freight houses and to deliver and pick up cars from connecting lines or industrial plants, the car-miles per man-hour is a better index for measuring the degree of labor

utilization in yard service. As already mentioned, inspite of the improvements made in recent years, the number of car-miles per man-hour in 1924 was still 5% below that of the base year. To that extent the labor in yard service was less utilized in 1924 than in 1915. Mention should be made, however, as to the effect of the amount of traffic carried upon the number of car-miles per man-hour produced, as it is in the case of yard locomotive performance. In years of great traffic, yards are usually congested which makes switching difficult and slow down yard movement, hence the decrease in car-miles per man-hour produced, another effect of the business cycles. Thus during the period under study, as the number of equated traffic units increases, the number of car-miles par yard man-hour decreases although not proportionally as shown in the following table:

YEAR	EQUATED TRAFFIC UNITS (INDEX NO. TABLE I)	CAR-MILES PER YARD MAN-HOUR (INDEX NO. TABLE XIII)
1916	+ 25	— 13
1917	+ 32	— 20
1918	+ 42	— 14
1919	+ 34	— 25
1920	+ 47	— 8
1921	+ 13	— 5
1922	+ 20	— 9
1923	+ 43	— 11
1924	+ 34	— 5

(Computed from Tables I and XIII)

The utilization of labor in these three classes of service is further analyzed by a study of the performance of locomotive crews in their respective field of operation.

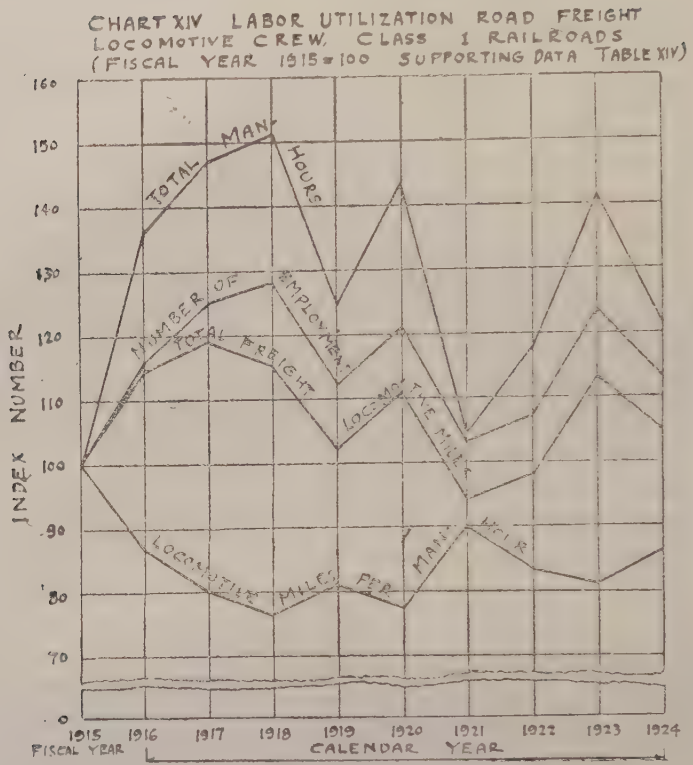
a. Labor Utilization—Road Freight Locomotive Crews. The increase in recent years of the freight locomotive crews has been much greater than the increase in locomotive-miles. Theoretically speaking the increase in man-hours should be proportional

to the increase in the number of employment, but due to the payment of overtime and punitive rates, the increase in the number of man-hours of the road freight crews has been disproportionately great in recent years with the exception of 1921 as shown in Chart XIV on the following page. This disproportionately great increase in man-hours may or may not be justified. A certain per cent of man-hours was paid for but never worked, such as hours allowed for the cancellation of a proposed run when the crew was already summoned, hours paid for road delay to which freight locomotives are often subjected and other idle hours that are not productive. The reasons for these unproductive hours, however, are not revealed by statistics and their justification or non-justification requires personal inquiry on the spot. Thus in 1921, out of 77,616,240 hours paid for, 62,718,881 hours were actually worked, or 81% were productive. In 1922, the productive hours were 77% of the total, in 1923, 76% and in

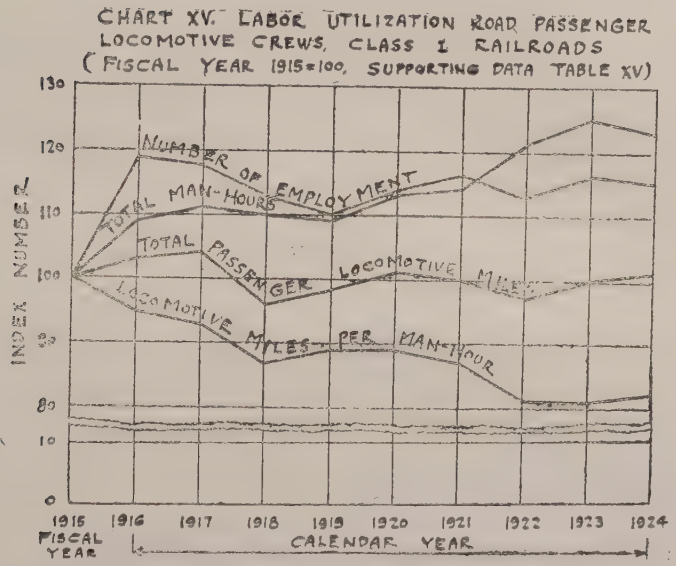
YEAR	TOTAL HOURS PAID FOR	STRAIGHT TIME ACTUALLY WORKED	PER CENT OF TOTAL
1921	77,616,240	62,718,881	81
1922	168,087,655	129,017,704	77
1923	200,418,490	153,190,325	76
1924	173,236,570	137,923,937	79

(Wage Statistics, I.C.C.)

1924, 79%. But no matter what the reasons are, the effect of this unproductive part of the time paid for upon the number of locomotive-miles per man-hour is very material and the percentage of it should be checked as much as possible. Improvements in this respect have been made as indicated by the locomotive-miles per man-hour curve since 1920, but it was still 14% below that of the base year in 1924. This decrease in the labor utilization of road freight locomotive crews was largely responsible for the decreased labor utilization of the road freight service employees.



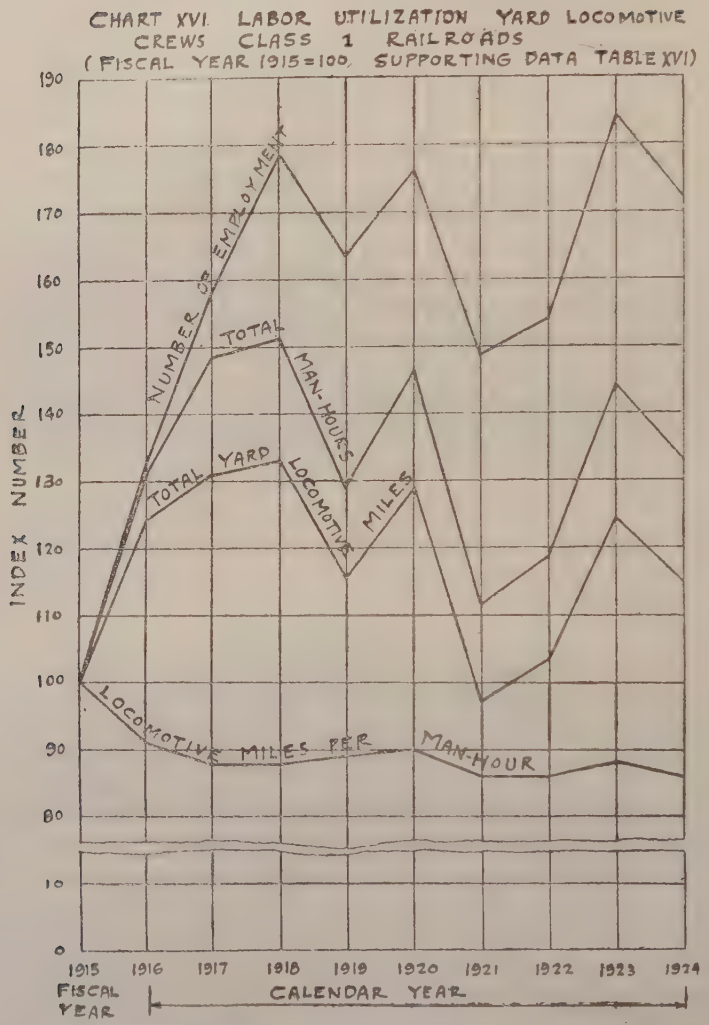
b. Labor Utilization—Road Passenger Locomotive Crews. The labor utilization in the road passenger locomotive crews has had similar unfavorable results, with this difference, however: up to 1921 the per cent increase in the total number of man-hours was less than that in the number of employment. This can be partly explained by the fact that road passenger locomotives are less subject to road delay and the passenger train service is conducted on fixed schedules, so the departure or arrival of passenger trains are more regular than freight trains. In this respect, the management has greater control than that in freight service; and therefore, it assumes more responsibility for the labor utilization of passenger locomotive crews.



YEAR	TOTAL HOURS PAID FOR	STRAIGHT TIME ACTUALLY WORKED	PER CENT OF TOTAL
1921	35,372,634	25,766,775	74
1922	68,864,581	49,929,565	72
1923	71,357,522	51,548,121	72
1924	70,532,760	50,933,438	73

(Wage Statistics, I. C. C.)

c. Labor Utilization—Yard Locomotive Crews. The managements' control over the labor utilization of yard locomotive crews is still greater than that of the passenger locomotive crews as they are not subject to conditions prevailing in other two classes of service. Therefore, we notice in Chart XVI that the per cent of total number of man-hours is much lower than the per cent of the number of employment. This is the more remarkable as the eight-hour basic day affects this class of employees most. As shown in the chart, the man-hour curve assumes a downward tendency inspite of the ascending tendency of the employment



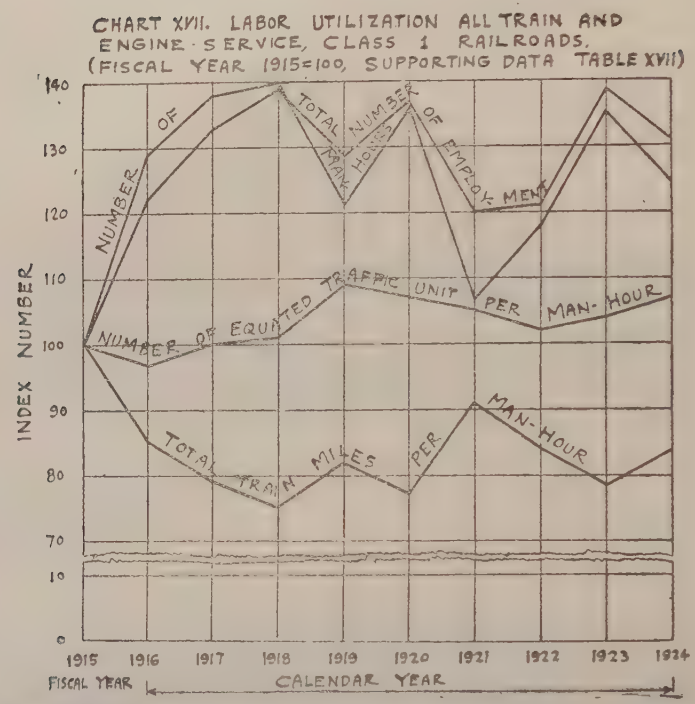
curve. By virtue of this the unfavorable situation of labor utilization of yard locomotive crews was not so serious as it was in the other two cases. The comparatively better utilization of yard locomotive crews is indicated by the per cent of straight time actually worked to total hours paid for in the following table:

YEAR	TOTAL HOURS PAID FOR	STRAIGHT TIME ACTUALLY WORKED	PER CENT OF TOTAL
1921	48,112,203	44,828,136	94
1922	102,922,133	93,896,536	91
1923	124,797,999	116,911,962	93
1924	114,768,942	104,691,850	91

(Wage Statistics, I. C. C.)

While the foregoing discussion shows a decreased utilization of railroad labor in the ten-year period under study, caution should be taken as to the validty of making such a conclusion as that the railroad managements have been inefficient to the extent that the labor has been less utilized. We used the fiscal year of 19 5 as the base year, but the eight-hour basic day came into existence in 1916. This alone was a material cause for the decreased per manhour production. Then we have observed that in years of heavy traffic, the very factors that helped to increase the perman-hour production in ton-miles and passenger-miles also operated to cause a decrease in per man-hour production of train-miles, car-miles, and locomotive-miles, as heavier train loading and car loading cut down the number of train-miles, car-miles and locomotive-miles. Then, too, in years of active traffic, yard and road congestions and delays further cut down the production of these three units while man-hours remained almost unchanged.

To picture in its entirety the utilization of railroad labor engaged in all train and engine service the following chart is constructed. To measure the relative value of per man-hour of work to the railroads, the equated traffic units per man-hour is used; and to measure quantitatively the productivity of these employees, total train-miles (freight and passenger) per man-hour is used. It is fo be remembered always that the latter is influenced by a number of conditions which have been previously mentioned and are not disclosed in statistics.



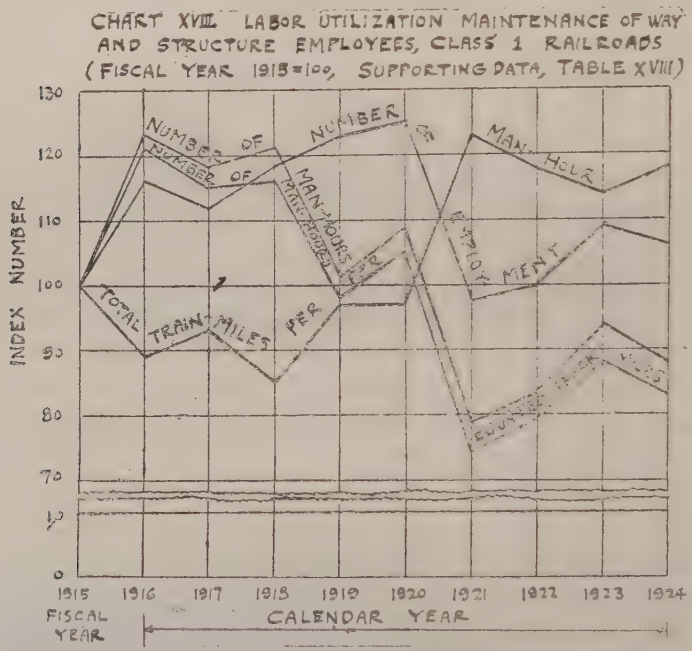
The number of equated traffic units per man-hour increased from 525.2 in 1915 to 567.2 in 1924, a gain of 7%. The number of train-miles per man-hour decreased from 1.48 in 1915 to 1.24 in 1924, a loss of 16%. As measured by the number of equated traffic units per man-hour, then, railroad labor in all train and engine service has been better utilized, and as measured by the number of train-miles per man-hour, it has been less utilized. Improvements, however, have been made in 1924 as indicated by the upward trend of both these two curves in Chart XVII. This increased utilization of labor in 1924 needs further comment. We notice that there always was an ebb in the train-miles per man-hour curve in years of heavy traffic, namely, in 1918, 1920 and 1923. But inspite of heavy traffic in 1924, the train-miles per man-hour curve was raised instead of lowered.

2. Labor Utilization, Maintenance of Way and Structures Employees.

The duty of the maintenance of way and structures employees is to keep the lines of the railroad, including bridges and other structures, up to the specified standards for the safe and efficient operation of trains. In 1924, the number of employees engaged in maintaining road and structures made up 21.89% of the total railway employees of the Class I railroads. In measuring the efficiency in the utilization of this class of employees, the total number of equated track miles and the total number of train-miles (freight and passenger) are used as the production and the total number of man-hours paid for as the divisor. The latter has been employed as an additional unit on the assumption that wear and tear of tracks as well as the road bed are to some extent affected by the number of trains which passed over them. The Commission's classification of employees before 1920 was not the same as today. Therefore, in computing the number of man-hours worked by the maintenance of way and structures force, only such divisions were used as are safe for comparative purpose, the titles of which were mentioned in the supporting data, table XVIII.

During the period under study, the number of miles of equated tracks has been only slightly increased. In 1915, it was 303,285.1, and in 1924, it was 323,647.7, an increase of 7%. While the number of employment has likewise been increased slightly, being 6% in 1924 (see Chart XVIII), the number of man-hours actually decreased since 1920 to 88% of the base year figure. This decrease was a material factor in the much increased production of per man-hour for the maintenance of way and structures employees. Thus, while in 1915, it took 2,918 man-hours to maintain one mile of equated track, it took only 2,395 man-hours in 1924, a decrease of 17% which is same as an increase of 17% in the per man-hour production. (This curve is different from the rest in that a downward trend indicates an

increase in efficiency and vice versa, for the number of man-hour is too large to be used as a divisor.)



The labor productivity of the maintenance of way and structures employees as measured by the number of train-miles per man-hour also shows an increase in recent years. In 1915, the number of train-miles per man-hour was 1.27. The per man-hour production in the following five years was somewhat less, but considerable gain was made since 1921. In 1924, the train-miles were 1.51 per man-hour or 18% more than that in 1915. The trend of both these two curves, train-miles per man hour and man-hours per mile of equated track, indicate the increased utilization of the maintenance of way and structures employees.

3. Labor Utilization, Maintenance of Equipment Employees.

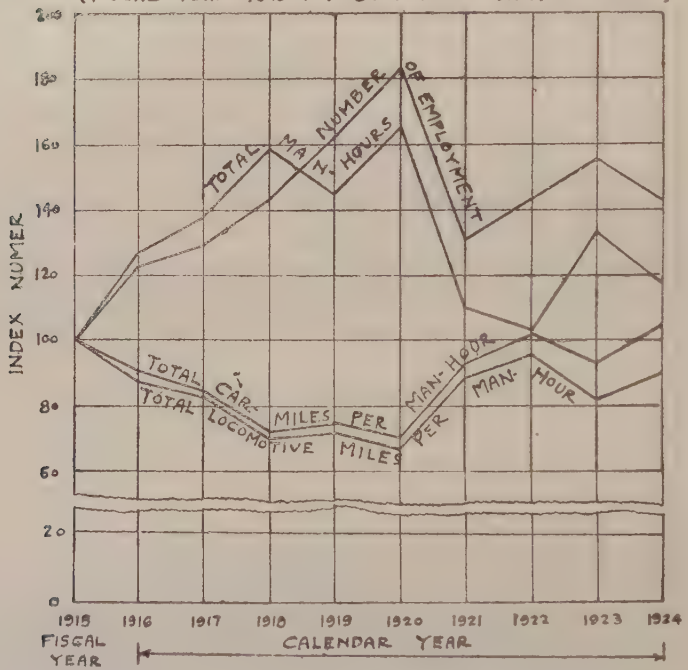
The number of employees engaged in maintaining railroad equipment and stores claims the largest percentage of all railroad

employees, being 30.10% in 1924. (In this study only certain divisions of Maintenance of Equipment employees are included.) The main duty of these employees is to keep railroad equipment, that is locomotives, cars and other tools of transportation in condition according to specified standards for the movement of traffic. As the number of repairs and the extent of each repair on all the locomotives and cars are largely dependent upon the number of miles the locomotives and cars run during the year, so the total number of locomotive-miles and car-miles in freight, passenger and yard services is the best available unit for measuring labor efficiency or rather labor utilization of the maintenance of equipment force.

We will notice in Chart XIX on page 54 that the number of employees in this group increased continuously from 226,486 in 1915 to 414,852 in 1920 an increase of 83%. Man-hours increased in the same way except in 1919 when a 13% drop was made. Both curves went up again in 1923 as the result of heavy traffic and consequently need for motive power.

It is to be noticed also that the ups and downs of these two curves generally coincide with the traffic curves in Chart I, train-miles curves in Charts IVA and VIA, locomotive-miles in Charts VIIA, VIII and IX. This is because of the fact that as there is more traffic to be moved more car-miles, train-miles and consequently locomotive-miles are needed. This means more locomotives and cars need to be either restored to their rating locomotive mileage or to be repaired for carrying traffic. Data on the number of classified repairs (locomotives and cars) began to be collected in 1924. But as the number of hours spent and the extent of work done for each repair vary greatly with the different units of equipment repaired, it can hardly afford any accurate basis of comparison. Units used in this study are subject to the same criticism, but are used for want of better statistics.

CHART XIX. LABOR UTILIZATION, MAINTENANCE OF EQUIPMENT EMPLOYEES, CLASS 1 RAILROADS (FISCAL YEAR 1915=100, SUPPORTING DATA TABLE XIX)



Since 1916, the number of man-hours of the maintenance of equipment force has increased considerably more than that of locomotive-miles and car-miles, resulting in the much reduced output in the units of total locomotive-miles and car-miles per man-hour. They were at the lowest in 1920 when the locomotive-miles per man-hour was 33% below the base year figure and the car-miles per man-hour was 30% below the base year. Improvements have been made since 1921, and in 1924 the number of locomotive-miles per man-hour was only 10% below that of 1915, while the number of car-miles per man-hour was 5% above that of the base year. As it was in the case of the productivity of train and engine service employees, the per-man-hour productivity

of the maintenance of equipment and stores labor is also affected by the percentage of service hours actually worked to the total hours paid for. Data in this respect is available from 1921, as follows :

YEAR	TOTAL HOURS PAID FOR	STRAIGHT TIME ACTUALLY WORKED	PER CENT OF TOTAL
1921	580,409,397	559,508,453	96
1922	1,158,750,413	1,051,295,898	91
1923	1,468,935,427	1,380,616,584	94
1924	1,273,443,935	1,229,510,986	96

(Wage Statistics, I. C. C.)

The three large groups of employees, whose utilization we have discussed, form 71.46% of the total railroad employees in 1924, and are largely responsible for the work of the railroads as a whole, Labor utilization, so far as these employees are concerned, has been less in the first half of the period under study, but since 1920 the trend has been that of increased efficiency in labor utilization. The explanation for the decreased utilization of labor during the first half of the period is to be found partly in the establishment of the eight-hour basic day and probably partly in the payment of hours paid at overtime and punitive rates and of hours paid for but never worked. (The table in Appendix III, adapted from the Wage Statistics of 1921 to 1924 will show that the unproductive hours were worst in the train and engine service.)

4. Conclusion

Our foregoing study of railroad statistics shows that the railroads in the United States have been able in recent year to handle more traffic, as measured by net ton-miles, with less propertional increase in train-miles by virtue of the great increase in the length of trains, in the load of trains and in the load of cars which were made possible not so much by an increase in the units of equipment, but by the considerable increase in the tractive capacity of the locomotives and carrying capacity of the cars. The

number of freight cars per freight train in 1924 was 16% greater than in 1915; the train-load was 31% greater; and the average car-load was 10% greater. The average number of passenger cars per passenger train in 1924 was 13% greater than in 1915. The number of passengers per passenger car and per passenger train was 10% and 12% greater respectively. The average mile of line of road carried 37% more net ton-miles and 9% more passenger-miles in 1924 than in 1915. As a whole, railroad facilities were best utilized during the war period and were less utilized since then. Better utilization, however, has been made in the last two years. The increased efficiency in operation, of course, will be either enhanced or reduced by the increase or decrease of efficiency in service.

Contributing to these increases made in the last few years have been increases in the average haul of a ton of freight, which was 10% greater in 1924 than in 1915; in the total tractive capacity of locomotives, which was 32% greater in 1924 than in 1915; and in the total hauling capacity of freight cars, which was 18% greater in 1924 than in 1915. The importance of more powerful and more economical and efficiant locomotives was recognized by the roads judging from the number of improvements made in recent years, such as, better design of locomotive boilers, superheater, fire-brick arch, thermic syphon, booster, mechanical stoker, feedwater heater, economical steam expansion, higher steam pressure, tracking relief improvements, and other factors that make for greater serviceability. No doubt, better locomotives were the most responsible factor in the roads' improvement in operation in the last year or so. The traffic was also handled in the last two years without congestion or car shortage. All these indicate that effort has been directed toward greater efficiency in the utilization of railroad facilities.

In the utilization of labor, there has been some decrease during the first half of the period in the per man-hour production of the three major classes of employees, transportation (train,

engine and yard), maintenance of way and structures, and maintenance of equipment. In the measurement of labor utilization of train, engine and yard employees, two indices are used, namely, the total number of equated traffic units per man-hour and the total number of train-miles per man-hour. As measured by the former, the utilization of labor has been increased, being 7% in 1924. As measured by the latter, it has been decreased since 1915. Since the very factors that worked to increase the per man-hour production of equated traffic units also worked to decrease the per man-hour production of train-miles, therefore, as an evidence of inefficiency in the managements' utilization of labor, the decreased per man-hour production of train-miles, is a debatable one. However, better reults have been obtained since 1920.

Labor utilization of maintenance of way and structures employees was the most satisfactory of the three goups studied. The number of man-hours required to maintain an average mile of equated track has been reduced from 2,918 in 1915 to 2,395 in 1924 or a decrease of 17%. In the mean time the number of train-miles per man-hour has been increased since 1920, the increase in 1924 was 18% more than in 1915.

Up to 1920, labor utilization in the maintenance of equipment service has been most unfavorable as measured both by the per man-hour production of car-miles and locomotive-miles. Since 1921, however, the per man-hour production of car-miles and locomotive-miles has been improved especially the per man-hour production of car-miles which was 5% greater in 1924 than in 1915.

Contributing to the decreased utilization of all three classes of employees has been the establishment of the eight-hour basic day and the payment of overtime at punitive rates. Our analysis of service hours of all these classes of employees as well as other groups of employees reveals that in years of high percentage

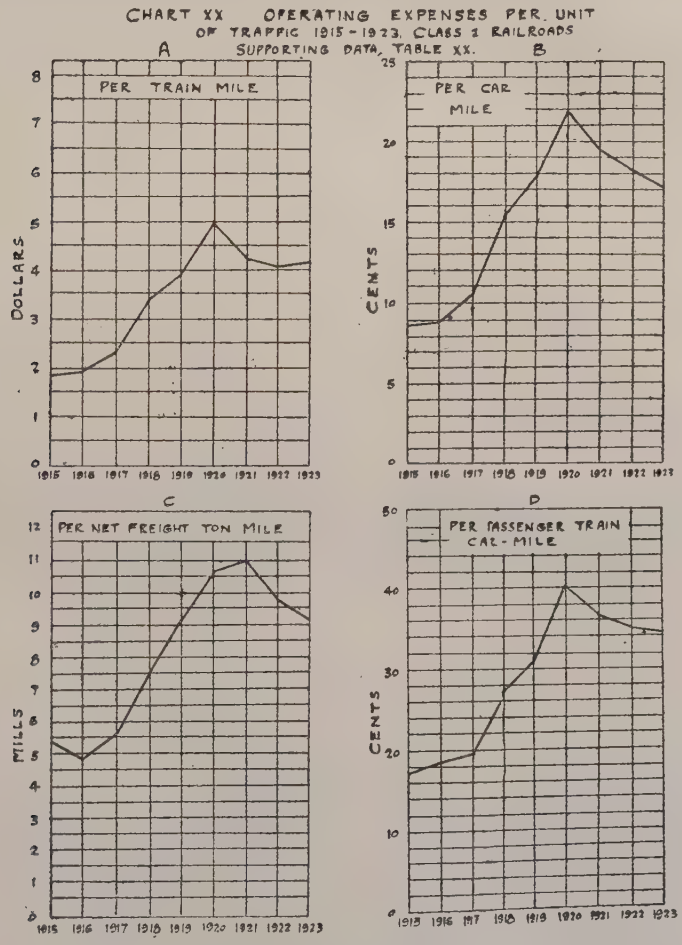
of unproductive service hours there also a low percentage of the per man-hour production of transportation service. The managements, however, may or may not be responsible for the unproductive hours according to circumstances which statistics do not disclose. But it is of great importance that the managements should strive to cut them down to the lowest possible minimum. This is being done, if the trend of all per man-hour production curves indicates anything at all.

Since 1920, there has been a very noticeable drop in the operating expenses per unit of traffic handled as shown by Chart XX on the following page. The operating expenses per train-mile decreased from $4.917 in 1920 to $4.135 in 1923, a decrease of 43%. The operating expenses per car-mile likewise decreased from 21.888 cents in 1920 to 17.070 cents in 1924, a decrease of 54%. The operating expenses per net freight ton-mile did not come down until 1921, which may be "explained by the fact that with a sharp decline in revenue freight in 1921 a large empty car mileage continued in that year."[1] From 10.963 mills in 1921, the operating expenses per net freight ton-mile decreased to 9.067 mills in 1923 or 35%. And the operating expenses per passenger train car-mile fell from 40.229 cents in 1920 to 34.431 cents in 1923, a decrease of 34%. A number of influences[2] were involved in effecting these large decreases in the per unit operating expenses since 1920, but it will be safe to assume that

1. "Unit Costs of Railroad Service, 1915-1923," a study submitted to the Interstate Commerce Commission by the Director of the Bureau of Statistics. Statement No. 24351 Sheet 14.

2. Such as, (1) changes in the level of material prices and wage rates; (2) changes in economy or efficiency resulting from (a) more capital investment, (b) invention of labor-saving devices or improved methods of operation, (c) changes in efficiency of labor per hour, and (d) better utilization of plant from denser traffic per mile of line; (3) adoption of higher or lower standards of maintenance; (4) changes in standards of service, such as greater safety, convenience, or speed of transportation, or in public requirements." Ibid. Sheet 24.

better operating efficiency in the last few years had contributed at least its share in the results obtained.



The increased efficiency in operation is indicated by yet another fact—the relative decrease of the amount of "transportation waste" in its many forms, such as the payment of damages due to injuries to persons, cost of clearing wrecks, damage to property, damage to live stock on right of way, and loss and damage

to freight and baggage. As shown in Chart XXIA on the next page the absolute amount of "transportation waste" in 1924 was 35% higher than that in 1915 but it was lower than any other years except those of 1916 and 1917. The relative amount of "transportation waste," however, has been continuously decreasing since 1920 as shown by the ratio of "waste"-to-total-operating revenue-per-cent curve in Chart XXIB. (This curve is influenced by price of commodities. The extent of which, however, cannot be determined). The ratio was lowest in 1924. While the total operating revenue in the last ten years was doubled, the ratio of "transportation waste" was actually cut by almost half. This is a clear indication of the increased efficiency in operation realised by the care exercised by men and supervising officers in the movement of trains and handling of freight.

The "transportation waste" curve in Chart XXIA generally follows the rise and fall of the transportation train-miles curve indicating that the amount of transportation waste is to some extent effected directly by the number of train-miles run, according to the law of average.

So far we have discussed and demonstrated the usefulness of statistics in an effort to study the operating efficiency railroads. But statistics alone are not sufficient. Useful and indispensable as they are, they "suffer from all the limitations of two-dimension space; arranged in serried lines and columns, having height and width, they lack the depth which alone give that perspective in which relationship may be truly fixed."[1] For statistics assisted by graphs only indicate changes in the several elements of operation, they do not disclose to us why such have taken place. They point the changes to us, warn us for action, and aid us in forming judgment, but they cannot take the place of judgment. In other words, statistics are a means to an end and not the end itself. In order to use them intelligently and profit-

1. Loree L. F. "Railroad Freight Transportation" p. 245.

CHART XXIA. RELATION OF "TRANSPORTATION WASTE" TO TOTAL TRANSPORTATION TRAIN MILES (FISCAL YEAR, 1915=100. SUPPORTING DATA TABLE XXI.)

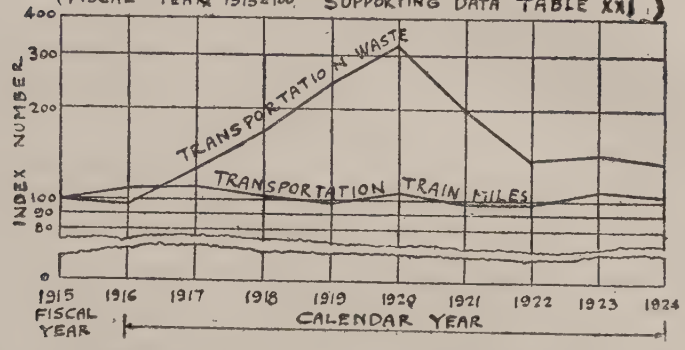
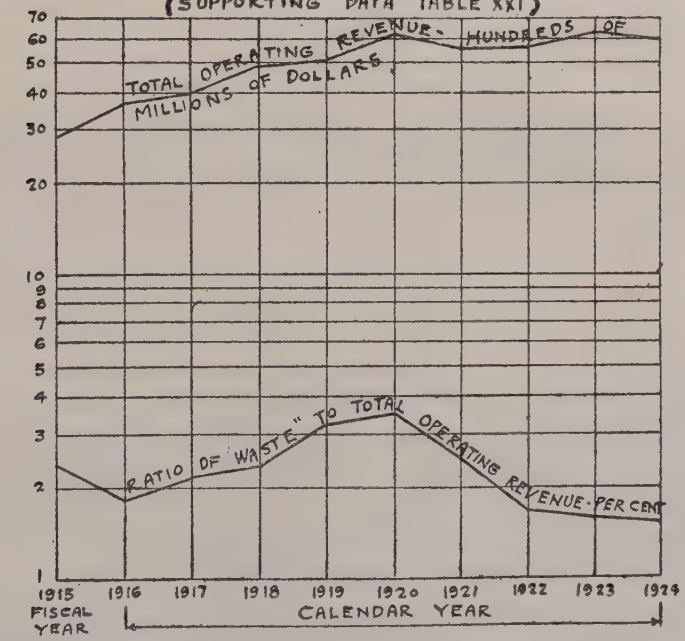


CHART XXIB. TOTAL OPERATING REVENUE AND RATIO OF "WASTE" TO TOTAL REVENUE (SUPPORTING DATA TABLE XXI)



ably and to draw conclusions or form judgment accurately, something more than statistics is needed. That something is a most intimate knowledge and familiarity with the property or

properties in question, in at least two respects, namely, the physical characteristics and the traffic characteristics of the property. Of the former, we may mention things such as the general topography, rates of ruling grades, amount of rise and fall, character of alignment, climatic conditions, freedom from washout, snow, sand, and of the latter, we may mention the kind and nature of traffic (retail or wholesale nature of the commodities carried), the length of haul, seasonal fluctuations of traffic, the "direction of prevailing traffic" or the balance of traffic.

In the study of the railroads in the country as a whole all these things are evened up by the law of average, but in the study of individual railroads or of roads in a certain region, the difference in operating averages between individual railroads of regions due to the effect of these physical and traffic characteristics is always extreme. As Wellington observed in his volume: "Whenever several lines are so situated that their business is largely competitive, and must be handled at the same gross price, but one or more of them has better grades, or a shorter line, or other special advantages, one line will permanently show a lower percentage of expense than the others, which will have no meaning as an indication of real excellence of management".[1] Thus the Pennsylvania Railroad, having the most direct line on traffic between points in the West and the Atlantic coast, will always have, under equal efficient management, a better operating ratio than the Erie, which, besides, has the worst unbalanced traffic and highest cost for locomotive repair as shown in the table on page 63.[2] The New York Central, as compared with the Erie in distance between the West and the Atlantic coast, is still more unfavorable, but its unequalled grades and the immense amount of local traffic favorably modifies its averages. Its local traffic

1. Wellington A. M. "Economic Theory of Railway Location" p 109

2. Adapted from the "Comparative Statement of Operating Averages, Class I Steam Roads in U. S. Years 1923, 1922, and 1921" Interstate Commerce Commission.

alone requires and supports all the staff and plant and enables it to handle its competitive through traffic as so much extra business, the only expense for which is the direct outlay for wages and fuel and a small amount of wear and tear of tracks. The comparatively lower ratio of the Baltimore and Ohio than the Pennsylvania is due chiefly to the greater relative volume of its coal traffic, which is always carried in full train load at low cost. The same effect is still more striking in the case of the Philadelphia and Reading Railway whose operating ratio is a little over 50%.

YEAR	MAINTENANCE OF W. & S. EXPENSES PER EQUATEDTRACK MILE	REPAIR PER LO COMO-TIVEIN SERVICE	% OF LOADED EAST BOUND	AVERAGE HAUL PER TON REV. FT.	REVENUE PER TON-MILE	OPERATING RATIO
NEW YORK CENTRAL R. R. (INC. B. & A. R. R.)						
1921	$2,905	$5,151	64.2	208.5	$.01232	76.9
1922	3,379	5,526	64.1	209.2	.01128	80.0
1923	4,095	8,229	63.2	198.5	.01040	77.4
3—YR AVER.	3,460	6,302	63.5	205.4	.01133	78.1
ERIE RAILROAD (INC. CHICAGO & ERIE R. R.)						
1921	3,406	8,781	65.8	247.2	.01064	92.6
1922	3,077	9,999	67.0	228.5	.01017	93.7
1923	3,455	11,191	63.0	225.3	.00957	81.3
3—YR AVER.	3,313	9,990	65.3	223.7	.01013	89.2
PENNSYLVANIA R. R.						
1921	4,090	8,914	64.2	216.4	.01094	86.1
1922	4,188	8,823	62.0	208.1	.01098	82.6
1923	4,549	10,984	62.3	196.9	.01045	81.9
3—YR AVER.	4,276	9,574	63.5	207.1	.01079	83.5
BALTIMORE & OHIH R. R.						
1921	3,042	7,332	63.5	198.5	.05099	83.8
1922	2,867	8,573	62.5	191.6	.04721	82.2
1923	3,606	9,770	62.2	192.2	.01102	78.0
3—YR AVER.	3,172	8,558	62.7	194.1	.03641	81.3

(Comparative Statement of Operating Averages of Steam Roads in U. S. Years 1923, 1922, and 1921, I.C.C.)

Statistics alone, then, afford no unmistakable indication of efficiency in railroad management, the cause of difference between roads even of the same region always lying deeper. We conclude,

therefore, that as the ramifications of railroad operation are so widespread, and the physical as well as traffic factors involved are so numerous, to speak of establishing a standard with which to measure as a yardstick the operating efficiency of the numerous railroads is forever impracticable and impossible although very desirable. The reason is, to qoute Wellington again, because "we cannot reduce the laws of topography, nor of even finance, to equations and formulae. Every line is a problem by itself, with its own peculiar physical and commercial conditions..."[1]

The result of this individual study has then demonstrated the extent as well as the limit which railroad statistics will allow us to go into the ascertainment of railroad efficiency. The scope of railroad statistics might be enlarged; our method of analysis might, doubtless, be improved and perfected; but that vital need of knowing facts and factors which are not revealed by statistics must be supplied, and it can be supplied only by investigation and field study. The Transportation Act of 1920 charged the Commission with the duty and clothed the Commission with the power of conducting such investigation. But how much has the Commission accomplished in this respect in the last five years? The following chapters will supply the answer.

VI

COMMISSION'S INTERPRETATION AND ADMINISTRATION OF THE EFFICIENCY CLAUSE

Not long after the enactment of the Transportation Act, the Commission commenced to decide how far they should go regarding this particular phase of government regulation of railroads and what plan or organization they should set up in order to carry out the new requirements of the act. The Commission, after considerable deliberation, came to the conclusion that, in the language of the Commission, "to go into the question

1. Wellington A. M. "The Economic Theory of Railway Location" p. 4.

of efficiency of management in a thoroughly effective way would necessitate an organization of experts especially qualified to investigate the numerous and complex phases of railroad management, such as shop methods, locomotive performances, road and terminal operation, maintenance of way and structures, purchasing, and many others. This would involve additional appropriation and would in some degree duplicate the work of the technical staff of the railroads. We have not been convinced that we are called upon to engage in the study of operating efficiency upon this elaborate plan. We have undertaken, however to emphasize to a greater degree than before the systematic comparison of operating results through statistical reports."[1] Therefore the original proposal to create a separate bureau was dropped. The work was assigned to Division 5 of the Bureau of Service to be manned by a certain force borrowed from the different bureaus of the Commission as occasion arises for such assistance. In May, 1925, however, a special "Section of Efficiency and Economy" under the jurisdiction of the Bureau of Service, was set up with four persons in charge of the affairs concerning efficiency and economy of railroads as required by section 15a.

According to the majority opinion of the Commission, under existing circumstances there are two avenues through which they may determine whether a reasonable degree of efficiency is being maintained and economy exercised by the carriers. In the first place, according to the Commission's opinion, there are the different bureaus dealing with various features of railroad operation such as the Bureau of Accounts, Bureau of Finance, Bureau of Service, Bureau of Locomotive Inspection, and the Bureau of Statistics.

The Hepburn Act of 1906 authorized the Commission to prescribe a uniform system of accounting for the use of common

1. 36th Annual Report of the Interstate Commerce Commission (1922) p 25.

carriers which, with certain modifications, is still in use. The system requires the carriers to make entries in the books according to the accounting rules prescribed by the Commission. To see that this is being observed, the Commission has a corp of field accountants making constant examinations; and their reports are reviewed. By analyzing the returns, it can be told whether any excessive amounts on any particular item have been expended. Prior to the war, the Commission had rather insufficient statistical information about railroad operation. For the intelligent control of the transportation system by the Railroad Administration, the Operating Statistical Section was created in 1918 and was charged with the duty to "arrange for, and supervise, the making of standardized reports and statistics pertaining to the maintenance and operation of railroads under Federal Control, and to make such compilations of statistics as may be required."[1] Under this provision a number of important statistical reports both monthly and annual were required of the carriers, upon which we largely based our study of operating efficiency in the previous discussions.

In addition to this system of statistical reports of operation, which has been kept up substantially unchanged by the Commission, there has been compiled since 1922 a "Comparative Statement of Operating Averages" of Class I steam roads for the purpose of making comparisons between roads in the same geographical division or between two or more divisions. These operating averages as well as other statistical data are constantly studied and analyzed by analysts of the various bureaus, especially the Bureau of Statistics, among whom are to be found a number of ex-railroad officers who possess a rich knowledge of practical railroading as well as of the physical and traffic peculiarities of the different roads in the country. If one railroad shows a less favorable operating average in a certain item, the query soon

1. Cunningham, William J. "American Railroads" p 371

leads them to find out the reason for the difference and whether such is justifiable under the circumstances. By making comparisons between different roads and with the same road at different periods the Commission is said to be materially assisted by these data in studying and observing the carriers' condition regarding honesty, efficiency and economy of management. Thus Commissioner Esch optimistically said that "We are confident that serious mismanagement would be promptly reflected in these reports... If a particular road should fall into the hands of a dishonest management, it is quite improbable that such a management could manipulate the reports and accounts with such consistency that all of the numerous comparisons we make would appear normal."[1]

The second avenue through which the efficiency and economy of management can be ascertained is special investigations conducted from time to time by the Commission. Up to the time of writing, three comprehensive investigations have been undertaken, one relating to the adequacy of locomotives and cars, one relating to expenditures of equipment, and one relating to repair work done on locomotives in outside shops.

By order of December 11, 1922, the Commission instituted an investigation as to the "adequacy of locomotives and cars owned by the common carriers and in the transportation of freight. It is ordered that the Commission upon its own motion, and without complaint, enter upon a proceeding of investigation into and concerning the adequacy of the locomotives and cars of all descriptions owned and of the locomotives and cars used by each such common carrier by railroad, and used in the transportation of freight between points in continental United States, and into and concerning the customs and practices prevailing or desirable with

1. "Statement of John J. Esch, member of Interstate Commerce Commission before Committee on Interstate and Foreign Commerce of the House of Representatives, May 21, 1924." Type written copy p 41.

respect to the ownership, use, and interchange of cars with a view to promoting economical and efficient service, to prescribing and establishing such just and reasonable rules, regulations, and practices with respect to car service, and to require the respondents to provide themselves with such safe and adequate locomotives and cars wherewith to perform as common carriers their car service as may upon such investigation appear to be contemplated and required by law."[1]

By this order, carriers are required to furnish dafa on eighteen elaborate forms prescribed by the Commission.[2] These forms are so designed as to reflect the sufficiency of equipment, and methods of handling equipment. Much time and labor have been spent in conducting this investigation and hearings are to be held. It is hoped that as a result of this study, conclusions may be drawn as to the sufficiency of the supply of equipment and the manner in which the several carriers have performed their duties in furnishing equipment.

The second investigation deals with the efficiency and economy of common carriers with particular reference to maintenance of equipment. By order of January 9, 1923, "the Commission, on its own motion and without formal pleading, enter upon a proceeding of inquiry and investigation into and concerning:

"(a) Whether expenditures by such carriers for the maintenance of equipment have been reasonable;

"(b) The manner and method in which the business of such carriers is conducted with special reference to the furnishing of 'car service'; and

"(c) Whether the courses adopted by such carriers in the maintenance of equipment and in providing 'car service' have

1. Docket No. 14489; Also "Hearings before the Committee on Interstate Commerce U. S. Senate 68th Congress, Ist session on S. 91 Etc., pp 750-1

2. See appendices A to R of Docket No. 14489; "Hearings" pp 752-71

been efficient and economical, and whether the service provided has been reasonably adequate."[1]

The order was accompanied by a questionaire on the subjects of Traffic, Locomotives, Cars and Labor. Information thus gathered is being studied and hearings are being held.

The third investigation relates to cases of repair work done on locomotives in outside shops at a cost exceeding that of similar work done in carriers' own shops. Up to the time of writing, reports on the following railroads have been submitted and decided by the Commission: Pennsylvania Railroad Co., New York Central Railroad Co., Atlantic Coast Line Railroad Co., Seaboard Air Line Railway Co., Chicago & North Western Railway Co., Chicago, Burlington & Quincy Railroad Co., Chicago, Milwaukee & St. Paul Railway Co., Philadelphia & Reading Railway Co., St. Louis—San Francisco Railway Co., Missouri Railroad Co., St. Louis Western Railway Co., Texas & Pacific Railway Co., Central Railroad Co. of New Jersey, and Erie Railroad Company. A study of the opinions expressed by the Commission in these cases will reveal a line of reasoning by which the carriers' honesty or dishonesty, efficiency or inefficiency, economy or uneconomy will be judged. This, however, will be deferred to a later chapter.

Two Commissioners dissented from the statement made by Commissioner Esch before the House committee (see page 67), which seems to say that the Commission has satisfactorily discharged its new duties in every way. In the first place, the Commission's authority to enforce such matters is questioned. Thus Commissioner Eastman in his separate expression said "Under the act as it stands we (the Commission) have no authority to enforce such efficiency and economy, but may make proper allowances for inefficiency or absence of economy in determining the level of rates"[3] And Commissioner McManamy in his separate

1. Docket No. 14556; "Hearings" p 772
2. Docket No. 12066 "Hearings" p 778
3. "Statement of John J. Esch...." p 52

expression said "Nowhere in the act do I find imposed upon us the duty to enforce honest, efficient, and economical management. But in my opinion, Section 15a does require us to inquire into and inform ourselves as to honest, efficient, and economical management, and to use such information in connection with the fixing of rates. In fact this information is necessary, otherwise it seems to me we can not determine whether or not such rates are adequate to yield a fair return to the carriers."[1]

In the second place, it is held that statistical reports and questionaires are insufficient and do not warrant definite conclusions. Something more than that is needed. "Reports and returns of this character often do disclose differences as between carriers which call for explanation, but the carriers are never at a loss for explanation and these can only be tested by thorough investigation of the facts by men with adequate expert knowledge. We have, broadly speaking, no organization properly equiped for such investigation, and in my opinion it would not be possible to build up such an organization without a large increase in our appropriation. Even then it would be difficult, for men of the requisite experience and ability can easily obtain employment with the carriers at salaries far beyond what the present law would permit us."[2]

Finally, the belief that through the service of various bureaus the Commission is fully informed as to honest, efficient and economical management is severely criticised as "erroneous". Commissioner McManamy thus said "our various bureaus are already over-loaded. Their functions relate only indirectly to the performance of our duty under section 15a... All of these bureaus were organized long before the enactment of the transportation act, 1920, and have other duties of definite nature to perform. These bureaus have not been increased for the purpose of inquiring into honest, efficient, and economical management.

1. "Statement of John J Esch...." p 54
2. Ibid p 52

Our Bureau of Service was created to meet the requirements of paragraphs 10 to 17 of section 1. The duties of that bureau relate almost entirely to car service and the handling of traffic. It does not inquire into honest, efficient, and economical management as that term is used in section 15a. Adequate car service is not synonymous with efficient management. A carrier may have sufficient locomotives and cars, and furnish adequate service, and still not be efficient or economical transportation organization."[1]

It seems that the Commission has been doing something in a way toward enforcing the requirements of the law regarding honest, efficient, and economical management, but due to a lack of funds and therefore a lack of hands has not set up any definite program for the enforcement of the obligation placed upon it by the act. Indeed, there have been some investigations conducted, but several years have elapsed since the investigation of them and so far only one investigation has been duly reported and decided. After reviewing those conflicting statements of the members of the Commission, we reason not without ground that the question seems not one of duty or authority for such is explicitly written in the act. If it is the duty of the Commission to prescribe "just and reasonable" rates, it is also their duty to enforce the requirement for efficient and economical management. How can the Commission neglect to inquire into and ascertain the conditions in which the roads are managed and yet be able to prescribe conciencious "just and reasonable" rates? To us, the real issue is a reasonable appropriation by Congress for the creation of an organization to enable the Commission to perform its duty satisfactorily. The language used by Commissioner McManamy in his separate expression quoted above can be interpreted only in this sense, otherwise, it would be self-contradictory.[2] This view is strengthened if we read the following extracts from his separate expression:

1. "Statement of John J. Esch...." p 55
2. Supra p 70

"In my opinion it is *absolutely* essential, if we fulfill the *duty imposed on us by section 15a*, that we have an organization whose duty it is to keep informed with respect to that particular subject. The information collected by the various other bureaus of the Commission is available and could be utilized as basic data. This organization could analyze the accounts and investigate such carriers as apparently need investigation. In no other way can we expect to obtain an explanation for difference in operating results "[1]

In yet another place, he used the following language: "No definite program has been established, or provisions made to keep informed with respect to honest, efficient, and economical management, *which I believe the law requires of us*. We have only in a few isolated cases made any investigation and only then into certain phases of management, calling on our different bureaus for the limited help that could be spared from regular duties. In my opinion we are fixing the income of the carriers without giving sufficient consideration to their expenditures. In conclusion, I believe that we are not complying with the requirements of section 15a in this respect and that we can not do so in the absence of an adequate appropriation for that purpose."[2]

The importance of reaching a definite understanding on this question can not be overemphasized when we think of the fact that the very inability of the Commission to supervise carriers' expenditures and operation on an organized basis has been the strongest argument for the repeal of section 15a.[3] So far as the language of the law is concerned, it is as explicit as can be. Although it does not say it is the duty of the Commission to be informed of such and such things, it does say, however, that the Commission is to fix rates "under" such and such conditions. To neglect the things expressed by the words following "under"

1. "Statement of John J. Esch....." p 56 (Underscoring mine).
2. Ibid p 58.
3. For the repeal of section 15a, see appendix II.

is to neglect the duty to prescribe "just and reasonable" rates. There can not be "just and reasonable" rates if there is inefficient or uneconomical or dishonest management. And it is the duty of the Commission to inform itself whether the railroad managements are efficient or not.

If this part of the law is not enforced, it amounts to a statutory guaranty or assurance of fixed return on investment without statutory supervision of expenditures and management. It will tend to kill incentive and to encourage waste and extravagant management, as the friends of the repeal of the section would call. It will furnish grounds to those who have fought hard to discredit the section and the transportation act as a whole. The provisions of section 15a are interdependent and the failure to enforce one will cause the whole rate-making machinery to stop functioning. The Commission can not be wrong in assuming the responsibility of enforcing the efficiency requirement. Senator Cummins said that "my understanding is if the commission is not doing it the quarrel or criticism ought to fall on the commission and not on the law."[1] But to be fair to the Commission, the criticism or quarrel should fall rather on Congress than on the Commission for Congress having placed such new duties on it failed to give it the wherewithal of enforcing them. The General expense of the transportation system, for salaries of railroad executives, officers, clerks, legal expenses, is approximately $175,000,000 a year, while the appropriation for the Interstate Commerce Commission is about $5,000,000 a year. Considering the regulatory duties of the Commission under the commerce act, the proportion between the two is not such a fair one.

The present staff of four persons in charge of the Section of Efficiency and Economy is necessarily insufficient to carry out the requirements of the law and to perform its functions satisfactorily for the following three reasons.

1. "Hearings" p. 69.

They are:

1. The Commission in granting rate increases and rate reductions in the past did not take into consideration the efficiency of railroad managements as required by the Transportation Act. In the Reduced Rates, 1922, the Commission based its decision solely upon the belief that, if reduced, the rates "would be likely to produce more net revenue for the carriers." The failure of the Commission in taking efficiency into considerations is to be attributed, however, to the meagre information on the subject it had at its disposal rather than anything else. Analysis of operating statistics do point out changes and fluctuations in operating averages, but they do not warrant us to draw the conclusion that operating efficiency is increased or decreased because of them. They might be the result of the influence of business cycles, or of changes in standards of service, or of actual changes in operating efficiency. The inadequacy of statistical information on operating efficiency, doubtless, would seriously handicap the Commission in its rate cases in the future. It is highly desirable that an organization be established which will furnish the Commission with the necessary facts gathered from field study as well as statistics from operating reports and that future decisions will not be based upon mere guesswork.

2. In the case of individual railroads filing application for rate increase, the Commission's need for special information regarding the road's physical and traffic characteristics and their effect on operating returns is more important than the information furnished by statistics. Such information can be obtained only by special inquiry and investigation on spot. At present, the force is too small to conduct any investigation of this sort with satisfaction.

3. Undoubtely, much information could be gathered from the existing bureaus of the Commission and their assistance is indispensable. But such could be used only to the extent as a

part of the material upon which the Section of Efficiency and Economy bases its study. The several existing bureaus can not take the place of the Section of Efficiency and Economy, because outside assistance rendered by other bureaus can not be satisfactory for a work which is not particularly their specialty. Moreover, such can not be used without interfering with their own work and resulting in decreased efficiency in the several bureaus. Therefore to be fair to the Section itself and also to the other allied services, the Section of Efficiency and Economy should be reorganized and expanded.

The next question will, of course, be "what should be the size of this organization?" This will depend upon the scope of the work the Commission deems both desirable and yet practicable to do. As the Commission's duty is that of regulation and not management, so it is out of question to have Commission's agents in every railroad office to supervise every operation of the railroads' business. It is the managements' business to manage. For the Commission it will be sufficient to have a force of reasonable size capable to keep a reasonable check upon the expenditures of the carriers and to keep a reasonable watch on the carriers' conduct of their business. Naturally we would like to know what this reasonable size of the organization is. To answer this question, we can not do better than to give the opinion of a member of the Commission who is an expert in actual railroading and was in charge of railroad motive power of the railroads in the whole country under the Federal Control. According to his opinion, based upon his actual experience in discharging a similar duty during the Federal Control, a force of about 100 persons will be able to do the work in a rather satisfactory way. To finance the project, a reasonable appropriation, also based upon his previous experience, of about between $150,000 and $200,000 will be sufficient.[1]

1. Statement of Hon. Frank McManamy, Interstate Commerce Commissioner. "Hearings" pp. 421-482.

Considering the millions that might be saved from year to year, we believe that Congress could not appropriate money to better advantage than to give the Commission all the money it needs in order to enable it to expand its present "Section of Efficiency and Economy" into fully equipped machinery to perform its duties properly, efficiently and effectively.

VII

COMMISSION'S POLICY

The Commission's policy in the administration of the requirements of section 15a is found and best illustrated by its decisions in the various cases regarding farming out locomotive repair work to outside shops at excessive costs, Docket No 12066–"Construction and Repair of Railway Equipment." The investigation extended to certain railroads only and so far only fourteen separate decisions have been rendered.

The result of this investigation shows that the respondent carriers farmed out locomotive repair work to outside shops at a cost, in the cases of Pennsylvania Railroad and New York Central Railroad, of $3,000,000, in excess of the cost for similar work done at their own shops. The aggregate excessive cost of all railroads under investigation amounts to over $16,000,000, according to the latest information.[1]

One of the common features of these cases is that with the exception of the Atlantic Coast Line Railroad Co. all the repair contracts were made without competitive bid. A second feature is that in the majority of cases, the repair contracts were on a cost-plus basis, that is, the cost of material, at stipulated prices, and of direct labor, plus a certain per cent of the distributed labor cost to cover all overhead expenses, plus a certain per cent of the whole for profit. The percentage of the last two items varies with different railroads as the following table[2] will show:

1. Interview with Commissioner McManamy.
2. This table applies to contracts awarded to Baldwin Locomotive Works only.

NAME OF RAILROAD CO.	PERCENTAGE OF DISTRIBUTED LABOR	PERCENTAGE OF THE WHOLE FOR PROFIT
Pennsylvania Railroad Co.	90%	15%
New York Central Railroad Co.	120	15
Atlantic Coast Line Railroad Co.	—	—
Chicago, Burlington & Quincy R. R.	110	15
Chicago, Milwuakee & St. Paul Rwy.	110	15
Philadelphia & Reading Rwy. Co.	90	15
Central Railroad Co. of New Jersy	90	15
Erie Railroad Co.	120	15

A third feature of these cases is that the respondents all claimed the justification of farming out locomotive repair works on the following three grounds:

1. Deteriorated motive-power condition at the end of Federal Control;

2. Increased demand for motive-power on account of either actual or prospective heavy traffic; and

3. Inadequacy of the carriers' shops to cope with the situation.[1] Beside these, several railroads introduced a fourth one, i.e., congestion on lines and the embargoes thus resulted.

1. Commissioner McManamy recounted before the Senate committee the following reasons for resorting outside shops:

(a) "The railroad shops have always been operated on the appropriation system, more or less, that is, they are allowed a certain amount of money to maintain equipment for the coming month. No one can tell just what emergency will arise during that month; therefore, it quite often happens that due to accident, or to may be a couple of collisions, that the appropriation is exhausted. On the 25th or may be 26th of the month, and it has for many years been the general practice under such conditions to discontinue repair work. Then again, the operation of the shop is governed, perhaps necessarily, by the amount of money available, and if it approaches the end of the fiscal year, and it is found that saving is necessary, it has been the general practice to reduce the shop force or to close the shop entirely for periods ranging from two weeks to a month, and sometimes longer. Well, a month's closing of shops during an entire year has wasted 8 1/3% of the total annual shop capacity and once gone, it is water

The thing which the Commission has to ascertain in these cases, is, then, the extent of the validity of these three excuses or grounds advanced by the carriers in justifying their farming out locomotive repair work at excessive costs. The chief sources of information which are available to the Commission in reaching an intelligent and impartial conclusion are the data collected by its investigators and those submitted by the witnesses of the respondents during the hearings. Having carefully examined and studied these source of information, the Commission found that:

1. Motive-power condition in majority cases was in a deteriorated condition; and

2. A great demand for motive-power in anticipation of heavy traffic was in existence.

However, the third ground of inadequacy of shop facilities with the exception of few cases[1] was not accepted and in some cases was severely criticised[2]. This is the crucial point in the entire investigation, because the real question is whether the

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over the dam; you can not get it back. That makes it necessary, or at least it was considered necessary, that when a rush of business comes and there is a large number of locomotives stored that are not in serviceable condition— bad-order locomotives— that they must hustle around amongest the outside shops for the repair of such equipment.

(b) "I think there is another reason in this case, because the question of repairing, we will say, 200 locomotives involves a considerable expenditure and requires a substantial plant, and there are not very many places in the country, or were not at that time, where such contract work could be undertaken.

(c) "A repair shop requires almost wholly different equipment than a construction shop. In the one case, the new material is prepared in various parts of the shop assembled, and all you have to do is to put it together. In the other case, the completed locomotive is sent into the shop and it is, what the locomotive men call, stripped, that is, all of its parts needing repairs are taken off, and you must have storage space for it and the different equipment."—"Hearings" pp 424-5.

1. Atlantic Coast Line R.R. I.C.C. 731; Seaboard Air Line Railway Co. 69 I.C.C. 158; Chicago & North Western Railway Co. 691 I.C.C. 145.

2. Pennsylvania R.R. Co. 66 I.C.C. 704; New York Central R.R. Co. 66 I.C.C. 751.

respondents could have done the work in their own shops or at least a large part of that. If the third reason is invalid, the other two also fall to ground. But this central proposition is again surrounded by a number of important considerations which in one way or another have shaped the course of the Commission's reasoning. An analytical review of the Commission's decisions in these sases reveals:

1. That repair work done in outside shops even at an excessive cost may be justifiable if respondent's shop situation actually warrants and due effort has been exercised in securing the lowest bid on the contract. Thus said the Commission in the Atlantic Coast Line R. R. Co. case that "While the record indicates that the contract costs were excessive, nevertheless they appear to have been the lowest offered to respondent; and, considering the character of the necessary work to be done, the limitation of the contracts to locomotives requiring that class of repairs, and respondent's shop situation which necessitated the contracts for seasonable relief, the record does not afford grounds for condemnation of the action taken." [1]

Again, in the Seaboard Air Line Railway Co. case, the Commission said that "The figures submitted tend to confirm respondent's estimation of the maximum capacity of its shops, and the accrued bad-order power was considerably in excess of that capacity at all times in 1918, 1919, and 1920. The figures also indicate that the shops were so fully utilized from the time private control wss resumed and the striking increase in traffic on the line began that no substantial increase in the output would have been reasonably possible. While some of the figures are rather close, it dose not appear that rewards of the contracts were unjustified." [2]

More plain language was employed in the case of the Chicago & North Western Railway Co. It said "However, the record

1. 66 I.C.C. 731.
2. 69 I.C.C. 158.

abundantly establishes the critical condition of respondent's motive power and respondent's inability to cope with the situation in its own shop, and, subject to the possibility that preliminary estimates might have resulted in better terms, fully justifies the resort to outside shops for assistance.''[1]

2. That repair contracts at excessive costs awarded because of a want of adequate facilities in their own shops which the excess expenditures would have supplied or gone far to supply are regarded as ''regretable'' and ''not in the interest of efficient and economical management,'' but short of an affirmative condemnation.[2]

3. That repair contracts awarded without sufficient investigation into respondents' own shop capacities are reproached but in absence of ulterior motive or intention are not dishonest doings of the management. Thus the Commission concluded in the Pennsylvania case that ''Weighing one thing after another, the record indicates to us that at best respondent was precipitate in resorting to outside shops... Upon a careful review of the record we conclude that a more thorough survey of respondent's facilities in the light of past demands and performances would have disclosed a capacity to do the work itself within a reasonable time by an appropriate coordination of efforts and by such added exertions as relieved the situation in the preceding year. The interveners' imputation to respondent of an ulterior or dishonest motive has no support in the record.''

4. Finally, that repair of locomotives at excessive costs is regarded as ''unreasonable expenditures for maintenance'' and ''improvident,'' as in the Erie case. The Commission said ''Clearly, economy and efficiency of operation were disregarded in making new contracts and in sending out additional locomotives

1. Similar language is used in the following cases: 69 I.C.C. 145; 91 I.C.C. 402; 91 I.C.C. 409; 91 I.C.C. 421; 91 I.C.C. 417; 91 I.C.C. 421; 91 I.C.C. 423; 91 I.C.C. 425.

2. 66 I.C.C. 704, also 66 I.C.C. 751.

while negotiations were being conducted for a final settlement with its striking employees during the latter part of September . . . Assuming, however, that the resort to outside shops was necessary during this period (strike), the great variation in the overhead charges[1] in the contracts executed at about the same time indicates a disregard of efficiency and economy in management, and respondent has not justified the tremendous increase in costs nor the extraordinary allowances for overhead which to a great extent made up such excessive costs. The record compels us to regard these expenditures as improvident." [2]

It has been argued that if the management in the absence of bad faith or ulterior motives, a mere mistake or judgment based upon the existing conditions and circumstances should not be condemned and the management is entitled to an affirmative

1. This refers to a series of contracts which provided for percentage additions to productive or applied labor which is directly responsible for the great excessive costs. The following table shows the average cost of repairs in the various shops as compared with the average cost for similar work done at respondents' own shops (table appeared on page 653, 93 I.C.C.)

NAME OF SHOP	NO. OF LOCO.	AVERAGE COST PER LOCO.		AVERAGE EXCESS PER LOCO.	TOTAL EXCESS	RATIO OF AV. COST IN OUTSIDE SHOP TO OWN SHOPS
		OUT-SIDE	OWN SHOP			
Crucible Co.	12	$64,857.76	$8,314.25	$56,543.51	$678,522.08	780
Baldwin Works	36	17,823.41	8,241.28	9,582.13	344,956.51	216
Buffalo Corp.	5	31,577.73	6,850.77	24,726.96	123,634.80	460
Staten I. Co.	6	34,714.16	4,724.16	29,989.88	179,939.32	714
Furguson Allan	4	17,122.29	4,890.76	12,231.53	48,926.13	350
American Co.	6	17,990.49	4,358.41	13,632.08	81,792.51	412
McMyler-Inter	11	43,323.81	6,377.65	36,946.16	406,407.76	679
Austin Co.	9	38,729.44	6,377.65	32,351.79	291,166.11	607
Devine Co.	2	8,495.95	4,227.93	4,268.02	8,536.04	200
Am. District Steam	1	15,622.02	1,927.22	13,694.80	13,694.80	815

2. 93 I.C.C. 659.

finding that the contract had due regard for efficient and economical managment and resulted in no avoidable or unreasonable expenditure.[1] "To err in judgment is not to violate the law, nor does the making of an excessive expenditure necessarily reflect inefficient or uneconomical management...Mistake may have been made, but there is nothing indicating that it was made in disregard of proper management."[2] But a mistake is a mistake, nevertheless, and such mistake resulting in excessive expenditures amounting to millions is not in the interest of the public considering that they are to form the basis of a fair return which the public has to pay. The management is paid for and is expected like the locomotive engineer to use his right judgment in the interest of all concerned. If an engineer used his bad judgment and failed to slow down his train while approaching a terminal and did damage to persons and property, he is to blame.

It is feared that criticism of this nature may do harm to the public itself instead of good. And its effect upon initiative and resolution of the responsible executives is even more far-reaching. As one Commissioner said: "If in the future the officials again should be confronted with what seems to them an emergency situation and they recall our criticism in the present case, they would do one of two things—either disregard our criticism and boldly go ahead and do what they thought they ought to do, as they should, or they would say: 'We did what we thought was best before and were repreimanded. Now we will play safe. We will try to repair the locomotives ourselves. If we fail, only the public will suffer. The responsibility will be on the Interstate Commerce Commission and our failure will never be known.' To encourage such an attitude and to so dissipate resolution, as it seems to me might be the effect of adopting the policy of our report, would be unwise. Man efficiency more than anything

1. See Commissioners Porter's and Campbell's dissent 63 I.C.C. 751; 731; 89 I.C.C. 759.

2. 89 I.C.C. 759.

else determines carrier efficiency. Our job is to increase where we can the efficiency of men. To this end, we should stimulate initiative, courage, and prompt action and a willingness to take on and quickly solve big problems. If railway operating officials, responsible for furnishing transportation for the public needs, are to stop before acting and wonder whether we are going to criticize them or not, as far as the country is concerned, will be far worse than the occasional losses which may occur through the courageous and prompt exercise of judgment."[1]

This feeling is only natural and human. But the reasoning behind seems to be based upon two misconceptions or misunderstandings. The one is the misconception of the distinction between the commission of a mistake and the ommission of a duty. By the ommission of a duty for the sake of avoiding the commission of a possible mistake does not free the operating officials from criticism. The other is the misconception of the regulatory power from executive control which belongs to the railroad management. The Commission is a regulatory body, as we have mentioned before, and by no means a railroad management. And the Commission has rightly followed this course in this investigation. They did not, as they should not, say to the railroads: "You shall repair your locomotives in your own shops," but they virtually said that "we don't care where you repair them, it is our regulatory duty and obligation to check up your repair costs to see whether or not such are reasonable and not excessive."

There is no binding order in these cases, but there is what was in the nature of a reprimand. Observing closely the facts of these cases, one comes to the conclusion that the reason why such findings were not made is not the lack of facts nor authority of the Commission to condemn the managements for waste, but the lack of a definite administrative policy on the part of the Commission which in turn was due to a lack of understanding of

1. 68 I.C.C. 716-17.

its duty under section 15a regarding the honest, efficient and economical management which we discussed in the previous chapter. As Commissioner Eastman said in his concurring opinion, "The facts so disclosed also make me unwilling to the statement of the majority with respect to respondents' motives in the premises. I do not understand that motive were under investigation and no finding, therefore, upon this matter is appropriate. But if it were our duty to make such a finding, I confess that the evidence has not left me free from doubt as to what the finding should be."[1]

The position of railroad managements, under circumstances, is, indeed, a very difficult one. What shall they do? If they provide and maintain their repair facilities sufficient to meet their needs at peaks of seasons or business cycles, it would mean added cost. If they provide their repair facilities only for their average needs, they would not be able to take care of the peak traffic without resorting to outside help which is usually performed at great expense for various reasons especially when every road come into the market for such service. Both courses are not in accord with the public interest. Probably the proper course for the roads to follow is to provide a certain margin of safety above what is sufficient for their average needs. The extent of this margin should be decided according to the normal growth of traffic in general as indicated by business cycles and the normal growth of the road's own traffic in particular which could be obtained by a study of the economic life of the territory covered and served by it. For any sudden or abnormal demand for transportation (such as war), outside help will be justified only after the managements have failed to find relief within their own shops and such outside help must be secured by bids and be reasonable.

1. 66 I.C.C. 710.

APPENDIX I. CONGRESSIONAL HISTORY OF THE REQUIREMENT FOR HONEST, EFFICIENT AND ECONOMICAL MANAGEMENT

1. The Genesis of the Transportation Act, 1920.

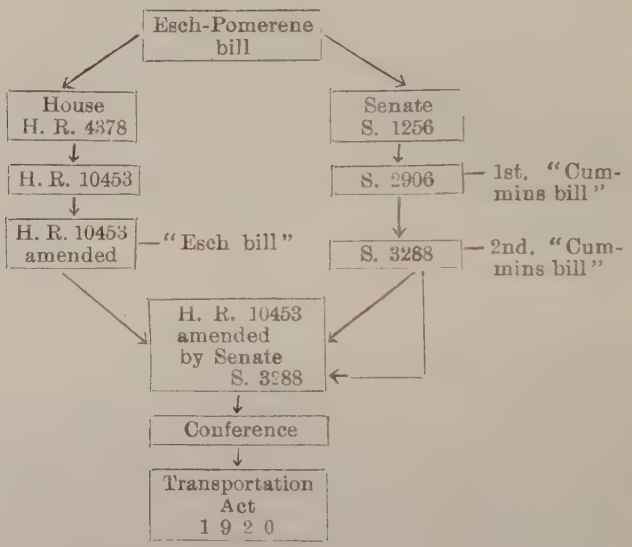
While the immediate genesis of the Esch-cummins bill, known officially as the Transportation Act, 1920, was the conference report on H. R. 10453, its ancestors must be traced back to the Esch-Pomerene bill, which was introduced in the House of Representatives by Representative Esch on June 2, 1919 as H. R. 4378 and by Senator Pomerene in the Senate on the same date as S. 1256.

Hearings on H. R. 4378 and other plans were finished by the House Committee on Interstate and Foreign Commerce on September 27. The Committee delegated to a sub-committee, of which Mr. Esch was Chairman, the work of drafting H. R, 10453 which was introduced by Mr. Esch in the House on November 17, H. R. 10453 was amended and passed by the House and became the so-called "Esch bill."

In the mean time; hearings on S. 1256 were held and on September 2, it was introduced in the Senate by Senator Cummins in the shape of S. 2906. This was the first so-called "Cummins bill." After further consideration, S. 2906 was introduced in the Senate by Senator Cummins on October 22 as S. 3288. This was the second so-called "Cummins bill."

H. R. 10453. as amended (the "Esch bill") was further amended by the Senate by substituting the S. 3288 ("Cummins bill") for everything after the enacting clause. The bill was then referred to a conference committee on the disagreeing votes of the two houses. "The committee... after full and free conference" agreed "to recommend to their respective Houses as follows: That the House recede from the disagreement to the amendment of the Senate, and agree to the same with an amendment as follows: In lieu of the matter proposed by the Senate amendment, insert the following—(the text of the Transportation

Act)."[1] The conference report was agreed to by the House on February 21 by a vote of 250 to 150 and by the Senate on February 23 by a vote of 47 to 17. The "Esch-Cummins bill" was approved by President Wilson on February 28 and became law, known as the Transportation Act, 1920. The following chart shows the gradual development of the Act:



2. The Origin of the Rule of Rate-making.

In amending the first four paragraphs of section 15 of the Commerce Act, the Esch-Pomerene bill (H. R. 4378 same as S. 1256) provided that "the Commission, in reaching its conclusion as to the justness and reasonableness of any rate, fare, charge, classification, regulation, or practice shall take into consideration the cost of labor and other operating costs in so far as they become material in any case under investigation."[2] The cost item constitutes but one of the factors or considerations in fixing a just

1 Cong. Record Vol. 59 p 3243.

2 MacVeagh, Rogers: "The Transportation Act, 1920" pp 524-5.

and reasonable rate and the Commission should take other things into consideration. Nevertheless, we regard this provision in the very first bill of this nature as the embryo from which the later elaborate structure of the rule of rate-making is developed.

After having been considered by a sub-committee, the Esch-Pomerene bill (H.R. 4378 same as S. 1256) was reported out in the shape of S. 2906. In introducing the bill in the Senate on September 2, Senator Cummins said that "The bill.....is the result of the constant, painstaking work of a sub-committee of the Interstate Commerce Committee."[1]

Besides authorizing and empowering the Commission as an amendment to section 15 of the Commerce Act "to determine and describe" upon complaint or in its own initiative "what will be the just and reasonable individual or joint rate,"[2] the bill went into great detail as to how this just and reasonable rate is to be determined and described. In section 6, the bill provided that "Rates of transportation shall at all times be just and reasonable. In changing or modifying them from time to time in the manner provided in the act to regulate commerce, as amended, and in viewing them from standpoint of their effect in producing revenue in any rate-making group as a whole, the Commission shall take into consideration the interest of the public, the shippers, the wages of labor, the cost of maintenance and operation (including taxes), a fair return upon the value of the property in the group and used for or held for the service of transportation, the requirements for additional capital in order to enable the carriers to adequately perform their duties to the public and the conditions under which the same can be secured; and for the purpose aforesaid, the Commission shall from time to time determine the value of the property in each district and so lower or advance the rates of transportation, as nearly as may be, to provide said fair

1. Cong. Record Vol. 58 p 4887
2. MacVeagh p 563

return as herein provided."[1] The importance of this language hardly needs comment. The trouble with the Commission has been that Congress heretofore merely gave it power to do a certain thing in a language so vague that it soon destroys its own purpose. The enumeration of the conditions or factors which the Commission is to take into consideration in determing a just and reasonable rate will serve as a yardstick with which the Commission is to determine the justness and reasonableness of a rate and will greatly facilitate the Commission to carry out its duties. It is, then the bill S. 2906, the first so-called "Cummins bill" which developed the rule of rate-making to a considerable and admirable degree.

Speaking in this connection in the Senate, Senator Cummins said that, "the insuperable difficulty which the Interstate Commerce Commission has always met, and which it has never been able to overcome in prescribing rates for the carriers of the United States is this: the diversity in the conditions surrounding the carriers, their physical conditions, the density of traffic they bear, the population which they serve, and many other considerations of like character have rendered it entirely impossible for the Interstate Commerce Commission to prescribe rate that would be at once fair and just to the public and fair and just to the several carriers."[2] Notice the last sentence. Therefore the proposed provision is an attempt to make it possible to have rates just and reasonable to all concerned.

S. 2906, the frist "Cummins bill," was further considered and improved by the Senate committee, and on October 22 it was introduced by Senator Cummins in the Senate in the shape of S. 3288, the second so-called "Cummins bill." This bill, so far as section 6 of S. 2906 is concerned, did not make any material change except the order of paragraphs were rearranged. But in

1. MacVeagh pp 541-2
2. Cong. Record Vol. 58 p 4887

its amendments to section of the Commerce Act, it mentioned for the first time the efficiency of operation as a factor in determining the justness and reasonableness of rates. Thus paragraph 3 of section 44 of the bill provided that "The Commission shall inform itself and take into consideration the efficiency with which the carriers are operated."[1] This was, however, mentioned in connection with the problem of describing just and reasonable division of joint rates between carriers and therefore was uncertain as to its application in the general rule of rate-making.

While in the Senate, the bill was severely attacked and equally enthusiastically defended. The debate indirectly drew in the question of management. Are the roads to earn the stardard return regardless whether or not they have been properly managed; whether or not expenditures are wisely made? And such similar questions. Thus attacking the rate-making section of the bill, Senator La Follatte said that "Now, sir, I have searched the bill in vain to find regulation of railway expenditures, whether in salaries, equipment or anything else, except that there is some indirect regulation of wages. But no one, I think, would ever argue that there would be any danger of railroads paying out too much in wages to employees. There is danger however, of their paying out and appropriating immense sums of money for salaries and expenses, and yet you will not find anywhere in the bill any check upon that side of the business.

"There is danger that the officials of the roads will organize construction companies and corporations by selling supplies and equipment to the roads and kindred operation, and in that way loot the roads of fabulous sums by excessive charges.

"Why not put a provision in the bill limiting the salaries of railway officials? I notice that... Judge Sims submitted a list of 208 general officers of railroads in 1917, before Federal opera-

1. MacVeagh p 594

tion including attorneys and receivers, drawing over $20,000 a year salary and running from $20,000 to $120,000 per year; and he proposed to limit the salaries of those gentlemen to $20,000 a year in so far as they were to be charged or against operating cost."[1]

We can readily learn between lines that without taking into consideration the honesty of the management, the efficiency and economy of operation, the bill would be regarded as one which is detrimental to the public interest. In winding up his speech on the solution of the railroad problem, Senator McKeller suggested four ideas for a proper railroad legislation. The fourth one related to the problem of rate-making, which reads: "Provide that existing rates shall be continued with full power vested in the Interstate Commerce Commission to raise or lower them and thereby fix reasonable rates, to the end that both the railroads and the public shall be fairly treated and that each road that is efficiently, economically, and well managed shall be permitted to earn a just and reasonable income, but without Government guaranty."[2]

The importance of these new factors—honesty, efficiency and economy in management—was also dwelt on by its sponsor. In defending the bill, Senator Cummins said that "One of these conditions is ability to borrow money.....we cannot compel men to invest money in railway enterprises, and therefore what we do must be..... the thing which will enable the railway corporations, honestly managed, honestly financed, to borrow the money necessary, first, to pay their maturing obligations, and second, to enlarge the facilities which, they now have and which are used for transportation."[3] The bill was reported out by Senator

1. Cong. Record Vol. 59 pp 511-2
2. Ibid p 468
3. Ibid p 126

Cummins without amendment. In the minority report, the bill was characterized as "revolutionary" and its provisions as "doubtful innovations and radical experiments."[1]

3. Deliberation of the Efficiency Clause in the House.

Meanwhile, the House Committee on Interstate and Foreign Commerce had finished its hearings on the Esch-Pomerene bill, H. R. 4378 and others,[2] and delegated, on September 27, to a sub-committee the work of drafting a new bill. On November 8, Mr. Esch, the Chairman of the sub-committee introduced in the House, H. R. 10453, the new bill, now known as the "Esch bill."

The Esch bill was the result of much painstaking work and exhaustive study in the railroad problems.[3] It was an elaborate document with four main titles. Title IV was entitled "Amendments to Commerce Act." The original amendment to section 15 provided in H. R. 4378 was improved. The wording in both bills was the same but difference appeared after the words "the regulation or practice so prescribed." For comparative purpose, we have laid down the two identical provisions side by side in the following page:

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1. 66th Congress 1st sess. 1919 Senate Reports Vol. I Report 304 Part 2 p. 1.

2. Speech of Esch Cong. Record Vol. 58 p. 8309.

3. In amending the bill Judge Sims applauded the sub-committee with the following words: "To do justice to the gentlemen who served on that sub-committee (of which Mr. Esch was Chairman) I beg to say that I do not think there ever was a more ernest effort, a more conscientious effort, made by any five men to try to serve the country's transportation needs in the best way that was possible to serve it through our efforts." Cong. Record Vol. 58 p. 8318.

H. R. 4378	H. R. 10453
The Commission, in reaching its conclusion as to the justness and reasonableness of any rate, fare, charge, classification, or practice shall take into consideration the cost of labor and other costs in so far as they become materail in any case under investigation.	The Commission shall be charged with the duty and responsibility of observing and keeping informed as to the transportation needs and the transportation facilities and service of the country, and as to the operating revenues necessary to the adequacy and efficiency of such transportation facilities and service. In raching its conclusion as to the justness and reasonableness of any rate, fare, charge, classification, regulation or practice, the Commission shall take into consideration the interest of the public, the shippers, the reasonable cost of maintenance and operation (including the wages of labor, depreciation, and taxes), and a fair return upon the value of the property used or held for the service of transportation.[1]

The Esch bill, H. R. 10453, besides creating new duties for the Commission to perform considerably developed and explicitly defined the theme of justness and reasonableness in rate-making. It, together with the first "Cummins bill," S. 2906, shows the earnestness and fairness of both Houses in the railroad problem and in an endeavor to solve it to the benefit of the country as a whole.

This section, which contains the rule of rate-making was not such as originally drawn by the sub-committee, but was put in by the full committee.[2] Comprehensive as it was, it was a compromise, and therefore, it was not perfect. The deliberation on the section was the occasion of the hottest debate in the

1. This entire language was stricken out by Mr. Barkley's amendment on November 17, 1919.

2. Cong. Record Vol. 58 p. 8656.

House and taxed the most talented eloquence. The particular provision of the rule of rate-making was short-lived. But it was in these House debates that the consideration of honesty, efficiency and economy of management was brought into discussion which laid the foundation for future incorporation of it in the law.

The severe criticism from the opposing camp on this provision was, however, not unexpected by its sponsor. In reporting the bill in the House, on November 11, 1919, Mr. Esch said that, "There is difference of opinion as to the necessity of putting a rule of rate- making into this legislation. The committee deemed it wise to insert such a provision to the end, I assume, that the Interstate Commerce Commission might have some authority in the law to point to in case their decisions and findings should be criticised. There is a danger in a rule of rate-making in this that unless we include all the elements that enter into the problem we do not meet that problem and we may provoke litigation. This is the danger in any rule of rate-making. My idea is that if there is to be a rule of rate-making the commission should be authorized to examine into the economy and efficiency in the operation of the carrier who seeks an increase of rates." [1] We notice the language of authorizing the Commission to examine the carrier's operating efficiency and economy is rather a weak one in that the Commission is to do so only when a carrier seeks an increase in rates. But even this weak form of provision was not incorporated in the proposed rule of rate-making. The result of this omission was that it greatly weakened the position of the entire section and caused the disappearance of it from the bill altogether.

The opponents of the section built up their arguments on the following three grounds:

1. That the elements involved in the determination of the reasonableness and justness of a rate are many and it is impractic-

1. Cong. Record Vol. 58 p. 8309.

able to write all of them in the statute. Thus Mr. Barkley, the leader of the opposition, said: "Now my objection is, in the first place, that I think it is very unwise.....to write into the law a statutory rule of rate-making, because there are so many elements that go into the decisions of the Interstate Commerce Commission as to the reasonableness and justness of any rate proposed by a railroad that it is practically impossible to write into the rule all the things that will enter into the equation. For instance, there are many roads in this country which have never earned any return on the value of their property, and the reason why they have never earned anything is because, in the first place, many of them ought never to have been built.....In the next place, many of the roads have been uneconomically managed, and by reason of such uneconomical and inefficient management and operation they have been unable to earn any return on th value of property."[1]

2. That the enumeration of only four of these elements will automatically exclude those not mentioned in the statute (including that relating to the honesty, efficiency and economy of management). To qoute Mr. Barkley again, "Under that language of the present law, in the act to regulate commerce, the Interstate Commerce Commission has built up a line of decisions, based upon the language which has been in the statute for the past thirty years, and also based on that language the Supreme Court has in a long line of decisions interpreted what was to be considered and might be considered in determining what is a just and reasonable rate. Heretofore Congress has never attempted to prescribe the power of the Interstate Commerce Commission in considering what would be a fair, just, and reasonable rate.

"By mentioning only a few things the Interetate Commerce Commission has heretofore considered, and which under the law and under the Supreme Court decisions they have the right to

1. Cong. Record Vol. 58 p. 8332.

consider, we incur the danger by implication of excluding all those other things they have considered, and one of those things which they ought to consider is the question of whether the road is economically and efficiently managed."[1]

This argument was supported By Mr. Towner who qouted from the decision in Raleigh V. Reid,[2] the following:

> "When a statute limits a thing to be done to a particular mode, it includes a negation of any other mode."

He again qouted the following from Stevens v. Smith:[3]

> "Where a thing is to be done in a particular way, by necessary implication the doing of the thing in any other way is prohibited."

To these remarks, Mr. Yates echoed:

> "Inclusio unius exclusio altuius".

3. That by prescribing a fixed fair return upon the value of property without considering the honesty, efficiency and economy with which the roads are managed and operated, it will result in fixing higher rates by the Commission than what is just and reasonable. Thus Mr. Barkley said, "Now, I am very much afraid that the language which the committee has written into the bill, compelling the Interstate Commerce Commission to take into consideration the entire expense of running the road, and on the top of that to bring about such a rate as will give to the road a fair return upon the value of its property, may compel the Interstate Commerce Commission to fix rates at such a high level that roads heretofore have never earned a dollar on the value of their property may receive such rates as will bring a return to them, regardless of the character of the management whether economically and efficiently or otherwise

1. Cong. Record Vol. 58 pp 8656-7
2. 13 Wallace 289.
3. 10 Wallace 321.

managed and operated; and therefore I believe it would be better to leave out of the law entirely and statutory rule of making rates, leaving it to the Commission to see that all rates, fares, and charges shall be just and reasonable, and allowing them to take into consideration every element in the management and operation of the road to determine whether it is entitled to a fair return upon the value of its property. But if the language shall remain in the bill, certainly it ought to be amended so as affirmatively to give the Commission the right and to charge it with the duty of considering at the same time whether the property has been economically and efficiently managed, so that they may survey the whole field upon the application of any carrier for an increase of rates." [1]

Meanwhile, Mr. Madden, in order to overcome the difficult situation and to improve the phraseology of the section, suggested that the words, "among other things" be inserted after the word "considered". This was brought up again by Mr. Sanders of the opposition and Mr. Montague who regarded "the language in the bill is not conclusive or exclusive of the consideration by the Commission of any other fact, matter, or principle in fixing a rate. In other words, the language is directory, not mandatory. It does not exclude other things . ." [2]

Mr. Esch with a view to save the provision, offered an amendment by substituting for the words "shall take into consideration" the words "shall give due consideration among other things to". The amendment was agreed to. But the conviction of the opposition of the inadvisability to retain the provision in the bill was so strong and their argument so impressed the House that when Mr. Barkley demanded a division on his amendment, [3] which is to strike out everything after the word

1. Cong. Record Vol. 58 p 8332
2. Ibid p 8659.
3. Cf. note 1. supra p 92.

"prescribed" of section 15 paragraph 1, the amendment was agreed to by a vote of 115 to 42. The Esch bill H. R. 10453, with amendment passed the House on November 17, 1919.

4. Deliberation in Conference.

Now the second so-called "Cummins bill", S. 3288, and the "Esch bill" as amended by the House have reached their final form in their respective Houses. So far as the rule of rate-making is concerned, the "Cummins bill" differed from the "Esch bill" in that the former contained a more or less imperfect rule of rate-making, while the latter kept the act to regulate commerce as amended as it was without providing one.

The "Esch bill" as amended by the House was read twice in the Senate on the same date as it passed the House, and was referred to the Senate Committee on Interstate Commerce. The Senate amended it by substituting the second "Cummins bill", S. 3288 for everything after the enacting clause of the "Esch bill". The bill, the "Esch bill" as amended by the Senate, was then referred to a conference committee on the disagreeing votes of the two Houses on the amendment of the Senate.

The difference between the "Esch bill" as amended by the House and the "Esch bill" as amended by the Senate is that the one continued the existing law by authorizing the Commission to prescribe just and reasonable rates, while the other added in section 6 of its amendment a requirement that the rates must be adequate to enable the carriers as a whole to earn a fair return on the aggregate value of their property, and that if from such rates any carrier's railway operating income exceeds 6 per cent of the value of its railway property, a portion of the excess shall be turnd over to the Government and placed in a railroad contingent fund, to be used for the purpose of making loans to or providing equipment for railroad carriers generally. The House yielded from its disagreement to these provisions of

section 6—against which, the House conferees stood for six weeks until its compromise was finally reached—and agreed to them as revised by the conferees in section 422 of the conference report[1], which was same as the text of the Transportation Act, and which contained, as a result of deliberation in the conference, a provision that in reaching the conclusion as to what constitutes a just and reasonable rate, the Commission is to consider among other things, the honesty, efficiency and economy of the railroad managements.

5. Deliberation and Final Passage of the Conference Report.

A. Deliberation of the conference report in the House. On February 18, 1920, the conference report was submitted by Mr. Esch in the House and by Senator Cummins in the Senate. The conference report was finally debated in the House on February 21. Mr. Esch, in presenting the conference report received frequent applause. After having explained the "material features of the bill", he pleaded that the House "must pass this legislation or there will be no legislation on the 1st day of March. The President, by proclamation issued December 24, ordered that the roads should return to private operation at 12:01 a.m. March 1... So that on the 1st of March the roads will return to private operation, and unless this bill is enacted there will be no legislation to take care of them in the interim. Will you run the risk? Will you fail to pass the bill to enable the roads to live?"[2]

Attacking the rule of rate-making provision of the bill, Mr. Barkley with his usual vigor, characterized it as "the most vicious and insinuous departure from established principles of equality and justice ever sanctioned by a legislative body... unprecedented, un-American, and unwholesome departure from

1. 66th Congress 2nd sess. House Report Vol. 1 Report No. 650 pp 67-8

2. Cong. Record Vol. 59 p 3271

the true functions of legislation..." [1] He objected to the bill because the guaranty nature of the rate-making section and because the recapturing feature and the efficiency requirement clauses were put in merely to give the proposed bill "a semblance of propriety". He eloquently concluded the debate with the following words: "Hence I protest against it. I protest against it in the name of the Constitution. I protest against it in the name of legislative propriety. I protest against it in the name of the sacred and fundamental doctrine of equal rights to all and special privileges to none, upon which the Nation was built and has grown great. I protest against it in the name of a hundred million people who will be compelled to pay tribute to the blunders of the past and the improvidence of the future. It is in this spirit that I express the hope that this measure may be sent back to the conference committee, when its objectionable features may be eliminated and a measure brought back which men can support without apology or regret, in the belief that they have performed their duty to their country." [2]

Evidently both speeches of Mr. Esch and Mr. Barkley were well received by the House, judging from the prolonged applause which they received. The debate went on with speeches pro and con. But the climax was reached when Mr. Mondell took the floor and said :

"Mr. Speaker, the hour is here when we are to have the opportunity to perform the greatest service to our country and our constituencies that we shall be privileged to perform during this Congress—that of advancing constructive railroad legislation to final enactment.

✣ ✣ ✣ ✣ ✣ ✣ ✣ ✣ ✣

"If this great measure, with its more than 100 pages of legislation, dealing with every feature and factor of the great transportation systems of the country, were entirely satisfactory

1. Cong. Record Vol. 59 p 3273
2. Ibid p 3277

in every detail to any one individual, I should be suspicious of it, for I realize, as we all must, that no two thoughtful, intelligent men can have exactly the same opinion relative to every one of the hundreds of important features of such legislation.

"The very fact that while its fundamental and basic soundness is practically unanimously admitted there is considerable difference of opinion with regard to some of its details affords the best possible evidence that the measure is a wise and workable product of our legislative system—a system under which the best judgment of trained legislators, formed after careful consideration, in the light of the widest possible information subjected to the test of debate and amendment in the two Houses, produces legislation representing the best judgment of a majority of the Congress.

✣ ✣ ✣ ✣ ✣ ✣ ✣ ✣ ✣

"The issue is so great, the interests involved are so vital, that no American constituency anywhere will allow any man to get away from hairsplitting, pusillanimous objections to some minor provision in this bill. The hour has struck in the orderly processes of our Government when a great piece of constructive legislation, having passed the test of committee consideration and been placed upon the legislative anvil, is now before us in the finished and perfected form. The responsiblity rests on us to say whether or not, notwithstanding stout and selfish opposition, we shall rise to the occasion, assume the responsibility the people have placed upon us, and vote for this conference report and against every motion that shall be made to delay the enactment of this wise, sound, constructive legislation." [1]

Mr. Barkley then moved that the conference report be recommitted to the committee on conference. The motion was rejected by a vote of 229 to 171 and was lost. The vote on the question of agreeing to the conference report was then taken.

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1. Cong. Record Vol. 59 pp 3314-5

The result was that there were 250 yeas and 150 nays and so the conference report passed through the House after a long legislative battle.

2. Deliberation and Final Passage of the Conference Report in the Senate.

The debate on the conference report in the Senate was not so eventful as it was in the House. In reporting the bill to the Senate, Senator Cummins emphasized two praticular points of the bill; they are, in the first place, "Honest and economical management and expenditures constitute an important and controlling consideration" in the process of rate-making, and in the next place, the bill, without the feature of a government guaranty, yet has "the advantage of certainty. It inspires confidence in investors, makes probable developments in our transportation system, and safeguards the public against the dangers and losses likely to result from an inefficient and inadequately maintained transportation system."[1]

The opposition, on the other hand, declared that "the provisions of this section (section 15a) are communistic and bolshevistic... They are certainly inimical to everything that we have heretofore believed to be a part of American principles."[2] and that it "is an invitation to waste and extravagance."[3] By a vote of 47 to 17, however, the conference report was agreed to by the Senate.

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1. Cong. Record Vol. 59 p 3332
2. Ibid p 3342
3. Ibid p 3341

APPENDIX II. THE PROPOSED REPEAL

Agitations for either modification or wholesale repeal of the important provisions of the Transportation Act were afoot soon after the passage of the act. During the five years that have elapsed, no less than fifty-five bills have been introduced in the two Houses. During the 68th Congress alone, twenty-five bills were introduced. Hearings on four of the Senate bills (S. 91 introduced by Senator Capper, S. 309 by Senator Gooding, S. 1919 by Senator Fletcher, and S. 2951 by Senator Dill) were held in April and May, 1924. Voluminous testimonies were filed by witnesses representing railroad executives, Association of Railway Utilites Commissioners, Chamber of Commerce of the United States, the American National Live-stock Association, National Industrial Traffic League, National Association of Owners of Railroad Securities, The Farmers' National Council etc.

It may not be out of place to mention in this connection the fact that in conducting the hearings, the Senate Committee reversed its usual procedure in that opponents to the proposed repeal or amendment were to be heard first instead of the sponsors of the several bills. The defenders of the Transportation Act, or rather of section 15a advanced the following reasons why this section should not repealed:

In the first place, it is section 15a that brings revenue consideration into the foreground as a primary factor in the rate structure. So far, the maxim of Government regulation of rates has been that rates must be "just and reasonable." In determining the justness and reasonableness of rates, the Interstate Commerce Commission is equiped with no statutory guidance as to what constitutes an equitable, just and reasonable rate. In the absence of such provision, a just and reasonable rate to the popular mind has come to be almost synonymous with a rate which barely covers expenses without giving due consideration to the carriers' ability to make necessary improvements and expansions to keep

pace with the general industrial progress of the country. The result has been a check on the railroad development and inadequate transportation facilities.

In considering reasonable rates, we must remember that there is a zone of reasonableness—a spread between rates fixed on the theory of "what the traffic will bear" as a maximum, and rates fixed on the theory of bare, "out of pocket", cost as a minimum. This zone or spread is most significant. If rates rise and pass beyond the maximum of what traffic will bear, the traffic will not move. If the rates decline and pass below the bare cost, the railroads are checked in their development and become unable satisfactorily to move the traffic. They cannot "make bricks without straw".

Now, section 15a is nothing but a recognition of this truth and it directs the Interstate Commerce Commission in exercising its discretion within the zone of reasonableness, not to pursue a mere starvation policy but to select rates within that zone which will have the effect of giving the carriers a fair return, if the volume of traffic and other economic conditions admit, upon the value of property. If, however, this section should be repealed or suspended and nothing is devised to take its place—probably there is nothing that will take its place as effectively as the present provision. It will throw this question of rate-making back into the impossible conditions which prevailed before the Federal Control and before the War. Therefore, it is urged that the law should be given a fair opportunity to try out until at least the after-effect of the War is worn out.

In the second place, section 15a is a "declaration of policy tending to inspire full confidence"[1] and to promote business stability. It is not a "guaranty" in that no money will be taken from the public treasury to make up the deficit of the carries if there should be any. It is simply an "assurance" to

1. Statement of Howard Elliot "Hearings" p 147

investors by making a moderate return reasonably certain to establish credit for the carriers and to secure for the public a lower capital charge than would otherwise be necessary. Since the passage of the Transportation Act, there begins to be a feeling of hope and confidence in railroad industry and in fact a new era began in railroad regulation and management. To repeal it would shake this confidence and make it increasingly difficult to go on with the work of expanding facilities as the country grows. Transportation development can not be adequate unless railroad credit is upon a sound and stable basis.

To the objection that no such assurance is given to security-holders of other industries, the answer would be that no one would like to have a limit set on the earning capacity of one's investment. Risk must be proportional to profit or prospect of making a profit. Besides, railroad securities are widely held and distributed. Of the $6,000,000,000 total deposit of all national savings banks in the United States, $1,000,000,000 is invested in railroad securities. Six billions are invested in railroad securities by national and state banks and educational institutions. The entire economic interest, industrial organization and the welfare of the people are intimately related with the railroads, therefore, an assurance to railroad security-holders by inspiring their confidence and trust in the wholesome condition of their investment in the railroads, is decidedly a most fundamental factor in maintaining and strengthening the business stability of the country. As J. D. Shatford observed that "Section 15a does not give us, the stockholders, as much as the Constitution of the United States, so that the repeal of this section would not take any rights from us; but the influence upon the already shattered credit of the railroads, through practically a notice to investors and stockholders throughout the country that Congress proposed to reverse its policy and oppose constructive legislation for the benefit of the transportation system, would completely destroy the ability of the carriers to finance their necessities on any possible terms. Such a condition

would be little short of a calamity. If, by reason of such action on the part of Congress, their purchasing power were to be curtailed even one-half, it can readily be seen that a disastrous effect such a condition would have upon an industry, when we consider that 31% of all the steel turned out in this country in 1923 was for the use of the railroads. Destroy the purchasing power of the railroads and their stockholders, and you destroy the prosperity of the country just as sure as the sun will rise and set tomorrow."[1]

In the third place, "it is the first time in the history of the Interstate Commerce act that the question of efficiency and economy in corporate management has been clearly brought within the affirmative jurisdiction of the Interstate Commerce Commission; and the repeal of this section would have no snch clause."[2] Heretofore, the Commission had no jurisdiction over efficiency and expenditure. Now, section 15a is the only provision in the interstate commerce act which affords a measure of inquiry into these matters upon the Commission's own initiative. And there will be no occasion for the Commission to say that "no matter what the revenue they (the railroads) may receive there can be no control placed by us upon its expenditure, no improvement directed, no economies enforced."[3] "If that should be repealed, the Commission would have no voice or right to inquire into these things.

It may be objected that "perhaps the Commission has the power but does not have the means of putting that power into operation,"[4] and that the Interstate Commerce Commission can inform itself as to the expenditures of the railroads only to the extent that it has accountants to investigate accounts

1. "Hearings" pp 654-5
2. Ibid p 323 Statement of Mr. Johnston.
3. 32 I.C.C. 329
4. "Hearings" p 628

which is not sufficient for the purpose and therefore supervision is inadequate, This is, however, not to say that the law is undesirable. It only "demonstrate that is a matter for Congress... (to) give them all the means that they need by appropriation."[1] So far as adequacy of supervision is concerned, it all depends on just how far one wants to go. As Senator Cummins frankly said that "it will probably be necessary, if you reduce to the last and most critical nicety—for the Commission to have an officer, or more than one, in the office of every railroad company in the land to see from the original source what expenditures were being made and what they were being made for. But I take for granted we would have to be satisfied with a little less supervision than that."[2] Since all accounts are required to conform to the accounting rules of the Commission and that detailed reports are to be filed with the Commission monthly or otherwise, any discrepency of irregularity on the part of the management will not be able to escape the expert observation of the Commission and its employees. Therefore, there is little risk of the carriers' padding accounts and imprudent expenditures. It is a moral pressure all the time. And it is this moral pressure or moral obligation which inspires responsibility and business morality upon which all human dealings are based and financial structures built. The requirement for honest, efficient and economical management furnishes such a pressure and standard of business morality and the repeal of which will not only take away the Commission's jurisdiction from such matters but also, by the simple reason of such an action on the part of Congress, amount to a negation of such requirement in fixing just and reasonable rates in the future at all.

In the fourth place, the rule of rate-making provided in section 15a is by no means new or socialistic in nature. Theory must conform to practical facts, in order to be of practical value.

1. "Hearings" p 629
2. Ibid p 71

In making rates, we are facing a dilema. On the one hand, there is the impossibility of prescribing rates for each individual railroads, and on the other hand, a uniform rate would give those roads either because of topographical or traffic advantages excessive earnings and on the other roads a starving return while the country needs the service of all its transportation facilities. The group idea and recapturing feature, to which the opposition objected angrily, were put in to meet this difficult situation. In fact, this had been the procedure which the Interstate Commerce Commission itself already found it necessary and actually adopted in rate adjustments, and upheld by the court. Thus Justice Brandeis, in his New England Division Case[1] said :

> "Obviously, Congress intended that a method should be pursued by which the task, which it imposed upon the Commission, could be performed. The number of carriers which might be affected by an order of the Commission..... might far exceed six hundred ; the number of rates involved, many millions. The weak roads were many. The need to be met was urgent. To require specific evidence, and separate adjudication, in respect to each division of each rate of each carrier, would be tantamount to denying the possibility of granting relief.....
>
> "For many years before the enactment of Transportation Act, 1920, it had been necessary, from time to time, adjudicate comprehensively upon substantially all rates in a large territory, When such rate changes were applied for, the Commission made them by a single order ; and, in large part, on evidence deemed typical of the whole rate structure. This remained a common practice after the burden of proof to show that a proposed increase of any rate was reasonable had been declared, by Act of June 18, 1910 c. 309.§12, 36 stat. 539, 551, 552, to be upon the carrier. Thus, the practice did

1. 261 U. S. 197.

not have its origin in the group system of rate-making provided for in 1920 by the new §15a. It was the actual necessities of procedure and administration which had led to the adoption of that method, in pass-upon the reasonableness of proposed rate increases."

Therefore section 15a is simply a legislative sanction of the rule of procedure which the Commission has been actually adopted and employed. To repeal it would leave the Commission's position uncertain in discharging its duties.

Finally, it was believed that the repeal of section 15a would give rate reductions. But the fact is that since August, 1920, when the rates were raised to their highest point[1] there have been reductions amounting to over $450,000,000 a year. That has been done and further reductions are being made all the time[2], despite of the fact that the carriers were not earning the fair return contemplated by section 15a. This was made possible with the belief that higher rates do not bring revenues if the volume of traffic is not normal or if the economic condition is unfavorable, and by the belief that relief could be obtained in increasing operating efficiency. As Mr. Willard testified before the Senate Committee, "It is only because of that increased efficiency to-day that the railroads are able to make the showing they have made, when they are only receiving 54 per cent more return per ton mile and it is costing them 100 per cent more to do the business.

"That section 15a," he continued, "as interpreted by the Commission and the Supreme Court has not failed to meet the expectations of Congress, is best evidenced by the fact that during

1. Ex parte 74, Increased Rates, 1920.

2. 15% reduction on grain from Buffalo etc. to Atlantic ports followed by 15 to 20% reduction on hay from mountain district, 13% west of Mississippi in 1921 and 1922, and the General Rate Reduction effective July 1, 1922.

3. "Hearing" pp. 22-3.

the year 1923, the railroads were enabled to inaugurate a program for new equipment, additions, and improved facilities larger than ever before in any 12 months' period, and also moved in a manner generally satisfactory, the largest volume of business ever transported in a similar period of time.

"I firmly believe that if the transportation act is left in its present form and given sufficient trial to further test its merits under more stable conditions, that it will be found that the railroads owned and operated under the terms of the act, in coordination with water and other forms of transportation, will continue to be able to furnish the people of this country with adequate transportation, at reasonable rates."[1]

With the reasons stated above, the defenders of the section pleaded that the section should be left alone, although the Transportation Act may not be perfect or the section under consideration may not be perfect. The Committee, to which the bills were referred, did not make a report on them. So, for the time being at least section 15a will stand as it is.

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1. "Hearings" p. 34.

TABLE I.

RAILROAD TRAFFIC. CLASS I RAILROADS.

(Data in the following Tables, unless otherwise indicated, were taken from Statistics of Railways in the United States and Monthly Reports of Operating Statistics.)

Year Ended	Gross Ton *Miles (Millions)		Net Ton Miles Rev. and Non-Rev.		Passenger Miles		Equated Traffic Units	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	701,579	100	302,786,500,454	100	31,789,928,187	100	398,156,285,015	100
Dec. 31, 1916	833,972	119	396,365,917,082	131	34,585,952,026	109	500,123,773,160	125
1917	889,855	127	430,319,014,635	142	39,476,858,549	124	548,749,590,282	138
1918	905,146	129	440.001,713,665	145	42,676,579,199	134	568,031,451,262	142
1919	814,619	116	395,679,051,729	130	46,358,303,740	145	534,753,962,949	134
1920	914,940	130	447,278,209,869	147	46,848,667,987	147	587,824,213,830	147
1921	760,716	108	340,862,150,770	112	37,312,585,966	117	452,799,908,668	113
1922	813,741	116	371,945,560,691	122	35,469,961,582	111	478,355,445,437	120
1923	987,326	140	456,237,879,523	150	37,956,594,827	119	570,107,664,004	143
1924	953,349	136	426,835,488,811	140	36,090,886,478	113	535,108,148,245	134

*From Estimates made by Bureau of Statistics I. C. C. (1915-1918 inc.) and from Monthy Reports for 1919 and subsequent years.

TABLE II.

TRACKAGE. CLASS I RAILROADS.

Year Ended	Miles of Road Operated		Miles of Second and Additional Main Track		Miles of Yard Tracks and Sidings		Miles of Equated Tracks	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	228.989.03	100	33,435.85	100	95,094.78	100	303,285.10	100
Dec. 31, 1916	231,674.09	101	34,128.88	102	98,334.25	103	308,154.31	102
1917	232,697.09	102	34,877.03	104	101,108.43	106	311,152.92	102
1918	233,144.58	102	36,029.96	108	103,262.92	108	313,600.01	103
1919	234,363.36	102	36,567.69	109	104,493.15	110	315,864.08	104
1920	235,233.93	103	36,736.49	110	105,408.29	111	317,326.26	105
1921	234,702.06	102	37,453.93	112	107,098.15	113	318,214.27	105
1922	234,976.31	103	37,703.01	113	109,463.23	115	319,870.33	105
1923	235,573.76	103	38,573.61	115	111,707.77	117	322,286.53	106
1924	235,839.16	103	39,606.52	118	112,247.25	118	323,647.70	107

TABLE III.

EQUIPMENT. CLASS I. RAILROADS

Year Ended	STEAM LOCOMOTIVES						FREIGHT CARRYING CARS (Except Cabooses)						PASSENGER CARS	
			Total Tractive		Average Tractive				Total Capacity		Average Capacity			
	Number	Index	Capacity (pds.)	Index	Capacity (pds.)	Index	Number	Index	Tons	Index	Tons	Index	Number	Index
June 30, 1915	61,883	100	1,970,295,300	100	31,839	100	2,258,855	100	89,837,847	100	40.0	100	52,690	100
Dec. 31, 1916	61,013	99	2,024,018,700	102	33,174	104	2,253,111	100	92,280,335	103	41.0	102	52,179	99
1917	61,533(1)	100	2,087,949,700	105	33,932	106	2,301,947	102	95,467,054	106	41.5	104	52,977	100
1918	63,531(1)	103	2,223,246,296	113	34,995	110	2,325,562	103	96,766,585	109	41.6	104	53,941	102
1919	64,618(2)	104	2,312,633,581	117	35,789	112	2,361,002	104	99,001,041	110	41.9	105	53,765	102
1920	64,368(3)	104	2,340,761,196	119	36,365	114	2,322,025	103	98,342,666	109	42.4	106	53,501	101
1921	64,585	104	2,385,469,940	121	36,935	116	2,315,595	102	98,504,017	110	42.5	106	54,331	103
1922	64,140	103	2,401,451,501	122	37,441	117	2,293,389	102	98,846,836	110	43.1	108	54,354	103
1923	64,939(4)	105	2,544,114,827	129	39,177	123	2,315,609	102	101,318,213	112	43.8	109	54,718	104
1924	65,006	105	2,592,993,685	132	39,735	124	2,348,676	104	104,148,002	116	44.3	111	55,042	104

(1) Excluding 15 Unclassified (2) Excluding 23 Unclassified (3) Excluding 14 Unclassified (4) Excluding 9 Unclassified

TABLE IV.

ROAD FREIGHT SERVICE—TRAIN PERFORMANCE. CLASS I. RAILROADS

Year Ended	Total Freight Train Miles		Gross Ton Miles per Train Mile*		Net Ton Miles per Train Mile*		Cars per Train		Average Haul per Ton		Freight Train Car Mile			
											Loaded		Total (I.C.;W.E.E.)†	
	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	561,181,729	100	1,250	100	539	100	35.7*	100	162.59	100	12,958,628,946	100	20,075,599,666	100
Dec. 31, 1916	641,314,832	114	1,300	104	618	115	36.3*	102	166.28	102	15,879,370,777	122	23,264,822,873	115
1917	654,757,314	116	1,358	109	657	122	35.6*	100	173.77	107	15,932,049,759	123	23,333,515,148	116
1918	638,903,099	114	1,418	113	689	128	35.8*	100	175.81	108	15,024,899,742	115	22,806,324,408	113
1919	571,779,014	102	1,422	113	692	128	37.4*	105	178.29	110	14,312,795,375	110	21,404,281,619	106
1920	629,305,382	112	1,453	116	711	131	36.6*	103	181.55	111	15,362,641,776	118	23,246,116,617	115
1921	529,574,699	94	1,436	114	644	119	38.4	107	181.48	111	12,480,345,664	96	20,345,744,465	101
1922	555,595,750	99	1,464	117	669	124	38.5*	107	184.30	113	13,964,736,854	108	21,355,902,531	106
1923	641,408,345	114	1,539	123	711	131	39.9	112	176.86	108	16,401,635,348	126	25,616,777,454	127
1924	600,518,329	107	1,587	127	711	131	41.7	116	178.85	110	15,884,917,251	122	24,992,040,213	124

*Computed from Basic Data

†(I.C.;W.E.E.) = Including Caboose; Work Equipment Excluded.

TABLE V.

DAILY AVERAGE OF CAR SURPLUS AND CAR SHORTAGE. CLASS I RAILROADS.*

	1918		1919		1920		1921		1922		1923		1924	
	Surplus	Shortage	Surplus	Shortage	Surplus	Shortage	Surplus	Shortage	Surplus	Shortage	Surplus	Shortage	Surplus	Shortage
January	24,106	107,289	355,488	1,036	12,460	75,704	293,288	1,286	415,053	513	25,445	73,162	262,980	2,373
February	21,645	148,762	451,739	2,162	5,760	85,409	396,814	543	271,263	562	23,101	75,227	131,221	6,083
March	31,971	82,555	472,936	1,512	5,862	82,727	450,483	413	216,684	437	13,157	73,535	195,206	832
April	59,721	45,886	367,666	2,106	8,560	80,339	493,081	215	334,675	473	13,507	46,601	309,007	307
May	86,263	15,058	286,984	2,156	3,089	92,272	434,809	287	332,940	1,148	22,411	22,235	328,356	209
June	83,563	20,557	192,910	4,644	1,010	115,561	380,728	400	261,990	2,935	53,850	12,220	358,929	74
July	92,339	33,905	107,900	19,271	1,625	115,540	353,532	2,083	212,609	12,131	76,110	7,481	345,583	96
August	64,792	28,870	58,301	43,215	1,403	131,247	274,721	1,901	121,387	42,919	73,512	8,899	266,230	203
September	66,988	21,248	13,464	64,068	3,174	92,748	207,884	1,520	20,818	97,949	59,371	12,826	155,374	412
October	105,479	13,788	6,257	49,509	2,650	66,557	111,272	6,733	4,475	160,787	27,393	14,518	99,256	1,326
November	167,177	10,250	51,767	48,824	28,128	30,858	182,452	1,775	5,209	154,771	91,982	3,551	153,013	449
December	270,177	833	42,170	48,460	131,119	10,046	396,371	187	9,179	99,953	240,936	340	232,233	196

*From Car Service Division, American Railway Association.

TABLE VI.

ROAD PASSENGER SERVICE PERFORMANCE. CLASS I. RAILROADS.

Year Ended	Passenger Train Miles		Passenger Train Car Miles		Passenger Car Miles (Pass., Sleeping, Parlor and Observation.)		Passenger Train Cars per Train		Passengers per Train		Passengers per Car		Average Journey per Passenger	
	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	564,480,611	100	3,231,381,464	100	2,078,812,953	100	5.72	100	56	100	15	100	33.95	100
Dec. 31, 1916	582,853,734	103	3,425,820,836	106	2,178,152,768	104	5.08	89	59	105	16	106	34.38	101
9117	582,380,318	103	3,506,843,201	108	2,234,806,367	107	6.01	105	68	121	17	113	37.01	109
1918	536,879,692	95	3,308,714,296	102	2,085,104,060	100	6.16	108	79	141	20	133	39.33	115
1919	546,114,692	97	3,469,042,189	107	2,217,506,275	106	6.34	111	85	151	21	140	39.36	116
1920	567,313,771	100	3,639,225,473	112	2,327,865,945	112	6.41	112	82	146	20	133	37.94	111
1921	561,617,158	100	3,531,275,739	109	2,235,145,906	107	6.28	110	66	117	16	106	36.03	106
1922	546,898,484	97	3,467,435,488	107	2,188,516,375	105	6.33	111	64	114	16	106	36.66	108
1923	566,305,904	100	3,636,437,167	112	2,293,499,360	110	6.42	112	67	119	16	106	38.46	113
1924	571,250,102	101	3,695,944,255	114	2,321,188,984	111	6.46	113	63	112	15	100	38.70	114

TABLE VII.

ROAD FREIGHT LOCOMOTIVE PERFORMANCE. CLASS I RAILROADS.

Year Ended	FREIGHT LOCOMOTIVE MILES:						Freight Train Car Miles per Locomotive Mile		Gross Ton Miles per Loco. Mile		Net Ton Miles Per Loco. Mile	
	Principal and Helper		Light		Total							
	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	609,594,693	100	28,697,381	100	638,292,074	100	32.35	100	1,150.87	100	425.42	100
Dec. 31, 1916	698,798,864	114	37,384,701	130	736,183,565	115	32.36	100	1,193.43	103	488.53	114
1917	713,998,296	116	37,382,903	130	751,381,199	118	31.79	98	1,246.29	108	521.05	122
1918	698,516,857	114	37,190,971	129	735,707,828	115	31.74	98	1,295.81	112	546.35	128
1919	616,138,406	101	33,520,432	116	649,658,838	102	33.83	104	1,322.13	115	555.83	131
1920	677,138,324	111	34,972,298	121	712,110,622	111	33.37	103	1,351.18	117	571.17	132
1921	565,626,109	93	28,603,063	100	594,229,172	94	35.13	108	1,344.90	117	511.03	120
1922	593,923,487	99	30,735,498	107	624,658,985	98	35.09	108	1,370.11	119	538.78	126
1923	689,011,053	113	36,273,642	126	725,284,695	113	36.13	111	1,432.96	124	565.36	132
1924	639,035,637	104	33,022,370	115	672,058,009	105	37.15	114	1,488.72	129	635.11	149

TABLE VIII.

ROAD PASSENGER LOCOMOTIVE PERFORMANCE. CLASS I RAILROADS.

Year Ended	PASSENGER LOCOMOTIVE MILES						Pass. Train Car Miles per Loco. Mile	
	Principal and Helper		Light		Total			
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	558,665,026	100	13,134,595	100	571,799,621	100	5.61	100
Dec. 31, 1916	576,052,517	103	15,400,652	117	591,453,169	103	5.75	102
1917	577,305,842	103	15,538,953	118	592,844,795	104	5.87	104
1918	532,190,026	96	14,190,238	108	546,380,264	96	6.01	107
1919	541,443,001	97	15,657,824	119	557,100,825	98	6.20	110
1920	562,518,475	101	16,261,026	124	578,779,501	101	6.26	111
1921	553,423,516	99	15,173,800	115	568,597,316	100	6.18	110
1922	538,147,359	97	15,829,207	120	553,976,566	97	6.23	111
1923	556,505,684	100	16,743,332	127	573,249,016	100	6.21	110
1924	558,532,210	100	17,224,042	131	575,756,252	101	6.41	114

TABLE IX.

YARD LOCOMOTIVE PERFORMANCE. CLASS I. RAILROADS.

Yard Ended	Yard Locomotive Miles		Car Miles (Passenger and Freight)		Car Miles Per Locomotive Mile		Net Tons of Coal Consumed	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	274,842,775	100	23,306,981,130	100	84.80	100		
Dec. 31, 1916	341,612,345	124	26,690,643,709	114	78.42	93		
1917	361,090,921	131	26,840,358,349	115	74.33	88		
1918	367,601,951	133	26,115,038,704	112	71.02	84	24,510,556	100
1919	316,744,186	115	24,870,323,808	106	78.52	92	20,983,283	86
1920	356,946,765	129	26,885,342,090	115	75.31	89	24,338,012	100
1921	364,595,897	97	23,877,020,204	102	90.24	106	18,237,483	75
1922	384,160,784	103	24,823,338,019	106	87.35	103	19,495,486	80
1923	342,215,494	125	29,253,214,621	125	85.48	101	24,067,644	98
1924	315,896,790	115	28,687,984,468	123	90.81	107	21,970,341	90

TABLE X.

TRAFFIC DENSITY. CLASS I. RAILROADS.

Year Ended	Gross Ton Miles Per Mile of Road		Net Revenue Ton-miles per Mile of Road		Passenger Miles Per Mile of Road		Freight Train Miles Per Mile of Road		Pass. Train Miles Per Mile of Road	
	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	3,504,880	100	1,199,093	100	139,226	100	2,451	100	2,469	100
Dec. 31, 1916	3,599,765	103	1,569,084	131	149,795	107	2,768	112	2,511	101
1917	3,819,790	109	1,698,825	141	170,088	122	2,814	114	2,552	103
1918	3,882,331	111	1,738,305	144	183,066	131	2,740	111	2,302	93
1919	3,475,885	100	1,558,081	129	198,345	142	2,440	100	2,330	95
1920	3,889,493	111	1,748,451	145	199,708	143	2,675	109	2,411	98
1921	3,241,199	93	1,308,938	109	159,551	114	2,298	94	2,392	97
1922	3,463,077	99	1,444,840	120	151,410	108	2,364	97	2,327	94
1923	4,191,150	119	1,754,901	146	161,777	116	2,722	111	2,403	97
1924	4,042,372	115	1,649,369	137	153,057	109	2,546	103	2,422	98

TABLE XI.

LABOR UTILIZATION ROAD FREIGHT SERVICE. CLASS I. RAILROADS.

Year Ended	Employment*		Man-Hours		Net Ton Miles Per Man-Hour		Freight Train Miles Per Man-Hour		Freight Train Car Miles Per Man-Hour	
	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	123,608	100	349,721,051	100	894.38	100	1.60	100	57.40	100
Dec. 31, 1916	154,027	124	474,069,914	135	836.08	94	1.35	85	49.07	86
1917	165,953	134	512,515,787	146	839.62	94	1.27	80	45.52	80
1918	169,819	137	520,425,075	148	845.46	95	1.22	77	43.82	77
1919	151,015	122	438,476,957	125	902.39	101	1.30	82	48.81	86
1920	163,774	132	505,039,179	144	885.63	99	1.24	78	46.02	80
1921	137,886	111	359,895,389	103	947.11	106	1.47	92	56.52	99
1922	141,879	114	403,450,828	115	921.91	103	1.37	86	52.93	93
1923	163,292	132	479,330,293	137	951.82	106	1.33	84	53.42	94
1924	149,664	121	416,511,494	119	1,024.78	114	1.44	90	59.99	104

*Road Freight Conductors, Brakemen and Flagmen, Road Freight Engineers and Motormen, Firemen and Helpers.

TABLE XII.

LABOR UTILIZATION ROAD PASSENGER SERVICE. CLASS I. RAILROADS.

Year Ended	Employment*		Man-Hour		Passenger Miles Per Man-Hour		Passenger Train Miles Per Man-Hour		Passenger Train Car Miles Per Man-Hour	
	Number	Index	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	53,915	100	144,695,875	100	219.70	100	3.89	100	22.33	100
Dec. 31, 1916	60,940	113	153,205,941	106	225.74	103	3.86	99	22.36	100
1917	60,983	113	156,033,312	108	253.00	115	3.73	95	22.47	101
1918	58,878	109	154,699,263	107	275.93	125	3.47	89	21.38	96
1919	59,904	111	155,566,730	107	297.93	135	3.51	90	22.29	100
1920	61,411	114	163,606,719	113	286.36	130	3.46	89	22.24	100
1921	59,036	109	169,181,024	117	220.54	101	3 32	86	20.87	94
1922	60,077	111	180,133,652	124	196.90	90	3.03	78	19.24	86
1923	60,500	112	186,264,033	128	203.77	94	3.08	79	19.52	88
1924	61,086	113	184,906,135	127	195.18	89	3.08	79	19.98	90

*Road Passenger Conductors, Baggagemen, Brakemen and Flagmen, other Trainmen, Road Passenger Engineers and Motormen, Firemen, and Helpers.

TABLE XIII.

LABOR UTILIZATION YARD SERVICE. CLASS I RAILROADS.

Year Ended	Employment.*		Man-Hours		Equated Traffic Units per Man-Hour		Total Car Miles (Pass. and Freight) per Man-Hour.	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	75,190	100	263,669,685	100	1,510	100	88	100
Dec. 31, 1916	98,143	130	350,450,235	132	1,427	95	76	87
1917	116,677	155	380,946,427	144	1,444	96	70	80
1918	130,274	173	393,233,579	149	1,444	96	75	86
1919	121,474	161	327,303,278	124	1,436	96	66	75
1920	127,452	169	375,839,043	142	1,564	103	71	81
1921	112,267	149	286,744,081	109	1,614	106	83	95
1922	114,733	152	306,635,546	116	1,560	103	80	91
1923	135,369	180	370,389,382	140	1,539	101	78	89
1924	125,682	167	341,968,565	129	1,565	103	83	95

*Yard Masters and Assistants, Yard Conductors (Foremen), Yard Brakemen, Yard Switch Tenders, Yard Engineers and Motormen, and Yard Firemen and Helpers.

TABLE XIV.

LABOR UTILIZATION ROAD FREIGHT LOCOMOTIVE CREWS. CLASS I RAILROADS.

Year Ended	Total Freight Locomotive Miles		Employment: Road Freight Engineers and Motormen, Firemen and Helpers.		Man-Hours		Locomotive Miles per Man-Hour	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	638,292,074	100	56,898	100	142,052,939	100	4.48	100
Dec. 31, 1916	736,183,565	115	65,312	115	193,004,981	136	3.86	86
1917	751,381,199	119	70,983	125	209,250,468	147	3.59	80
1918	735,707,828	115	73,092	128	215,509,277	151	3.41	76
1919	649,658,838	102	63,845	112	178,611,400	125	3.62	81
1920	712,110,622	111	69,350	121	206,139,235	144	3.45	77
1921	594,229,172	94	58,662	103	148,038,523	104	4.01	90
1922	624,658,985	98	60,879	107	168,087,655	118	3.71	83
1923	725,284,695	113	70,641	124	200,418,480	141	3.61	81
1924	672,058,009	105	64,361	113	173,286,570	121	3.85	86

TABLE XV.

LABOR UTILIZATION ROAD PASSENGER LOCOMOTIVE CREWS. CLASS I RAILROADS.

Year Ended	Total Passenger Locomotive Miles		Employment: Road Passenger Engineers and Motormen, and Road Passenger Firemen and Helpers.		Man-Hours.		Locomotive Miles per Man-Hours.	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	571,799,621	100	22,297	100	57,320,686	100	9.97	100
Dec. 31, 1916	591,453,169	103	26,560	119	62,509,980	109	9.46	95
1917	592,844,795	104	26,402	118	63,669,332	111	9.30	93
1918	546,380,264	96	25,128	113	63,047,190	110	8.66	87
1919	557,100,825	98	24,554	110	62,572,925	109	8.88	89
1920	578,779,501	101	25,560	114	65,096,904	113	8.89	89
1921	568,597,316	100	25,945	116	65,672,361	114	8.66	87
1922	553,976,566	97	25,201	113	68,864,581	121	8.04	81
1923	573,249,016	100	25,796	116	71,624,260	125	8.00	81
1924	575,756,252	101	25,651	115	70,532,760	123	8.16	82

TABLE XVI.

LABOR UTILIZATION YARD LOCOMOTIVE CREWS. CLASS I RAILROADS.

Year Ended	Total Yard Locomotive Miles		Employment: Yard Engineers and Motormen, Yard Firemen and Helpers		Man-Hours		Locomotive Miles per Man-Hour	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	274,842,775	100	24,174	100	85,875,811	100	3.20	100
Dec. 31, 1916	341,612,345	124	32,068	133	117,784,127	137	2.90	91
1917	361,090,921	131	38,449	159	128,408,200	149	2.81	88
1918	367,601,951	133	43,289	179	130,216,824	151	2.82	88
1919	316,744,186	115	39,656	163	110,868,850	129	2.85	89
1920	356,946,765	129	42,912	177	127,283,943	147	2.88	90
1921	264,595,897	97	36,229	149	95,595,294	111	2.76	86
1922	284,160.774	103	37,452	154	102,922,133	119	2.76	86
1923	342,215,494	124	44,806	185	124,797,998	145	2.83	88
1924	315,896,790	115	41,699	172	114,768,942	133	2.75	86

TABLE XVII.

LABOR UTILIZATION ALL TRAIN AND ENGINE SERVICE. CLASS I RAILROADS.

Year Ended	Employment		Man-Hours		Equated Traffic Units Per Man-Hour		Total Train Miles Per Man-Hour	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	256,713	100	758,086,611	100	525.2	100	1.48	100
Dec. 31, 1916	313,110	122	977,726,090	129	511.5	97	1.25	85
1917	343,613	133	1,049,495,526	138	522.8	100	1.17	79
1918	358,971	139	1,068,357,917	140	531.6	101	1.10	75
1919	332,393	129	921,346,965	121	580.4	109	1.21	82
1920	352,637	137	1,044,484,941	137	562.8	107	1.14	77
1921	309,189	120	815,820,494	107	555.0	105	1.34	91
1922	316,689	121	890,220,026	118	537.3	102	1.24	84
1923	359,161	139	1,035,983,708	136	550.3	104	1.16	79
1924	336,432	131	943,386,194	124	567.2	107	1.24	84

TABLE XVIII.

LABOR UTILIZATION, MAINTENANCE OF WAY AND STRUCTURES EMPLOYEES. CLASS I RAILROADS.

Year Ended	Employment*		Man-Hours		Man-Hours per Equated Track Miles		Total Train Miles Per Man-Hour	
	Number	Index	Number	Index	Number	Index	Number	Index
June 30, 1915	294,510	100	885,111,234	100	2,918	100	1.27	100
Dec. 31, 1916	343,493	116	1,090,450,703	123	3,538	121	1.12	89
1917	331,413	112	1,047,459,090	118	3,366	115	1.18	93
1918	349,157	118	1,069,790,575	121	3,411	116	1.09	86
1919	362,559	123	901,735,904	101	2,854	98	1.23	97
1920	367,866	125	973,065,239	109	3,066	105	1.22	97
1921	286,424	98	692,475,331	79	2,176	74	1.57	123
1922	294,143	100	729,312,634	83	2,279	79	1.51	118
1923	323,925	109	828,235,126	94	2,566	88	1.45	141
1924	313,733	106	775,310,535	88	2,395	83	1.51	181

*Consists of M. W. & S. Foremen, Section Foremen, Masons and Bricklayers, Structural Iron Workers, Section men, Foremen of Construction Gangs and work Trains—and other men in construction gang and work trains.

TABLE XIX.

LABOR UTILIZATION OF MAINTENANCE OF EQUIPMENT DEPARTMENT.

Year Ended	Employment* Number		Man-Hours		Total Locomotive Miles (Passenger, Freight & Yard)	Total Car Miles (Passenger Train and Freight)	Total Loco. Miles per Man-Hour		Total Car Miles per Man-Hour	
	Number	Index	Number	Index	Number	Number	Number	Index	Mumber	Index
June 30, 1915	226,486	100	646,419,019	100	1,484,934,470	23,306,981,130	2,297	100	36,056	100
Dec. 31, 1916	275,883	122	825,674,521	128	1,669,249,079	26,690,643,709	2,022	88	32,325	90
1917	293.195	129	894,393,835	138	1,705,316,915	26,840,358,349	1,907	83	30,009	83
1918	324,370	143	1,023,025,404	158	1,649,690,043	26,115,038,704	1,613	70	25,562	71
1919	370,029	163	936,356,388	145	1,523,503,849	24,873,323,808	1,627	71	26,563	74
1920	414,852	183	1,072,487,426	166	1,647,836,888	26,885,342,090	1,536	67	25,068	70
1921	297,993	131	705,270,679	109	1,427,422,385	23,877,020,504	2,040	89	33,855	94
1922	324,466	143	667,178,855	103	1,462,796,325	24,823,338,019	2,187	95	37,206	103
1923	353,065	156	871,152,459	135	1,640,749,205	29,253,214,621	1,883	82	33,580	93
1924	323,310	143	756,389,018	117	1,563,711,051	28,687,984,468	2,067	90	37,927	105

*Consists of General Foremen Maintenance of Equipment Department, Gang and other Foremen, Machinists, Boiler Makers, Blacksmiths, Air-brakemen, Car Repairers, other Skilled Laborers, and Machinists Helpers and Apprentices.

TABLE XX.

OPERATING EXPENSES PER UNIT OF TRAFFIC. CLASS I. RAILROADS*

Year Ended	Cost per Train-Mile		Cost per Car-Mile		Cost per Net Freight Ton-Mile		Cost per Passenger Car-Mile	
	Dollars	Index	Cents	Index	Mills	Index	Cents	Index
June 30, 1915	1.825	100	8.815	100	5.453	100	17.354	100
Dec. 31, 1916	1.960	107	8.988	102	4.892	90	18.270	105
1917	2.316	127	10.676	121	5.529	101	19.520	112
1918	3.418	187	15.388	174	7.666	140	27.548	158
1919	3.986	218	17.916	203	9.269	170	31.121	179
1920	4.917	269	21.888	248	10.775	197	40.229	232
1921	4.250	232	19.424	220	10.963	201	36.196	208
1922	4.078	223	18.114	205	9.685	177	34.926	201
1923	4.135	226	17.070	194	9.067	166	34.431	198
1924	—	—	—	—	—	—	—	—

From "Unit Costs of Railroad Service", a study made by the Bureau of Statistics, I. C. C.

TABLE XXI.

"TRANSPORTATION WASTE."

Year Ended	Total "Transportation Waste"		Total Operating Revenue	Ratio of "Waste" to Total Operating Revenue	Total Transportatien Service Train Miles	
	Amount	Index			Number	Index
June 30, 1915	$67,864,316	100	$2,871,563,047	2.36	1,125,662,340	100
Dec. 31, 1916	65,607,043	97	3,596,865,766	1.82	1,224,168,566	109
1917	85,745,052	126	4,014,142,747	2.14	1,237,137,632	110
1918	113,493,816	167	4,880,953,480	2.33	1,175,782,791	104
1919	167,830,504	247	5,144,795,154	3.26	1,117,893,706	99
1920	214,786,231	317	6,178,120,978	3.48	1,196,619,153	106
1921	134,267,741	198	5,516,598,242	2.43	1,091,191,757	97
1922	92,009,479	135	5,559,092,708	1.66	1,102,494,750	98
1923	97,900,134	144	6,289,580,027	1.56	1,207,714,249	107
1924	91,832,860	135	5,921,490,100	1.55	1,171,768,431	104

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I.C.C. 413; Missouri Pacific R.R. Co. 91 I.C.C. 418; St Louis Southwestern Rwy. Co. 91 I.C.C. 421; Texas & Pacific Rwy. Co. 91 I.C.C. 423; Erie Railroad Co. 93 I.C.C. 646

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ERRATA

Page	Paragraph	Line	Text
6	1	19	For "train-miles" read "train-mile"
20	2	5	For " throws " read " throw "
28	2	12	For "statements" read "statement"
31	1	10	Insert " were " after " locomotive-miles "
60	3	2	Insert " of " after " efficiency ".
96	1	2	For " and " read " the "
102	2	7	Insert " be " after " not "
106	1	16	For " discrpency of " read " discrepency or "
Bibliography II	2	line 2	For " U. U. " read " U. S. "